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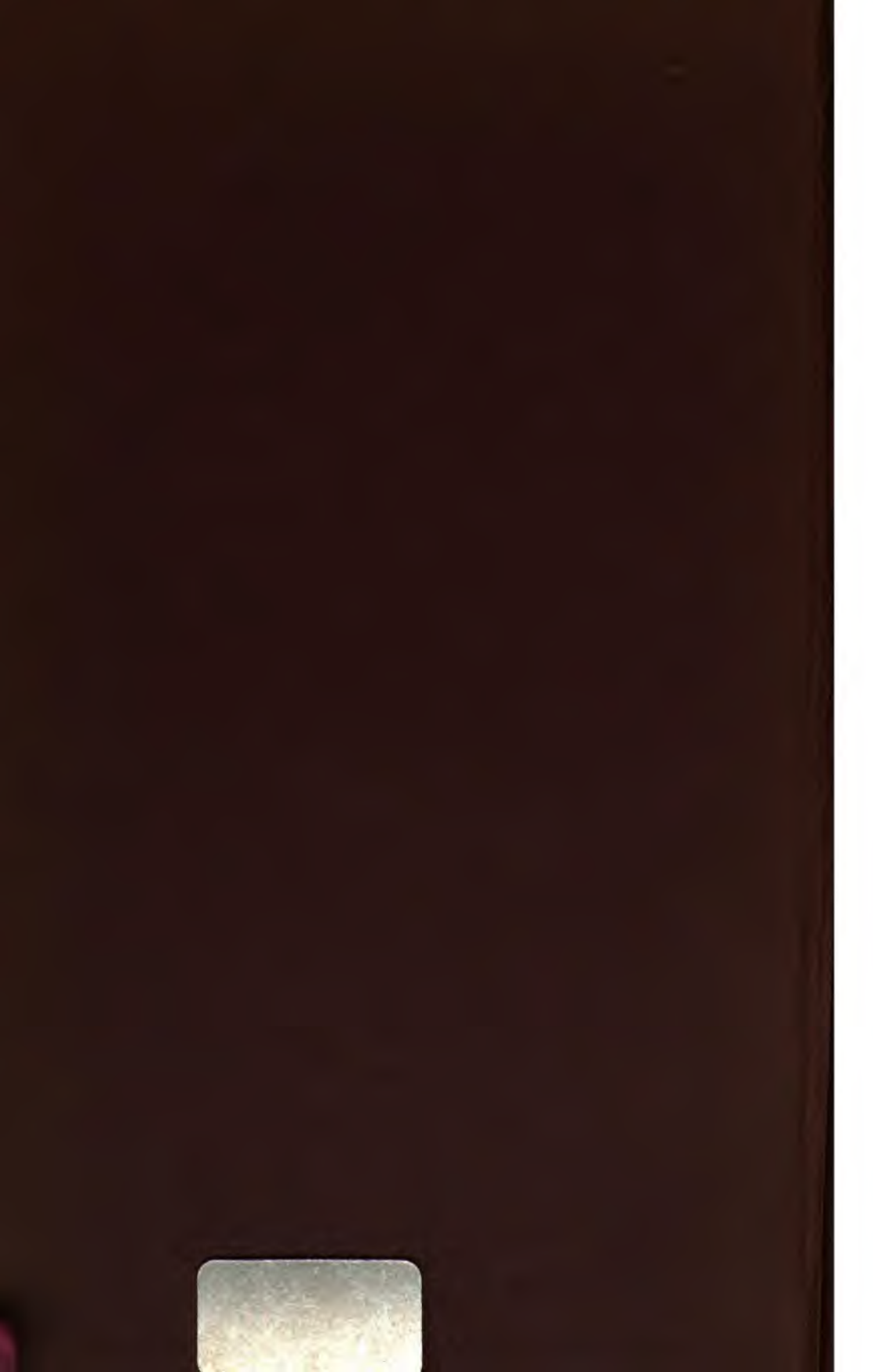
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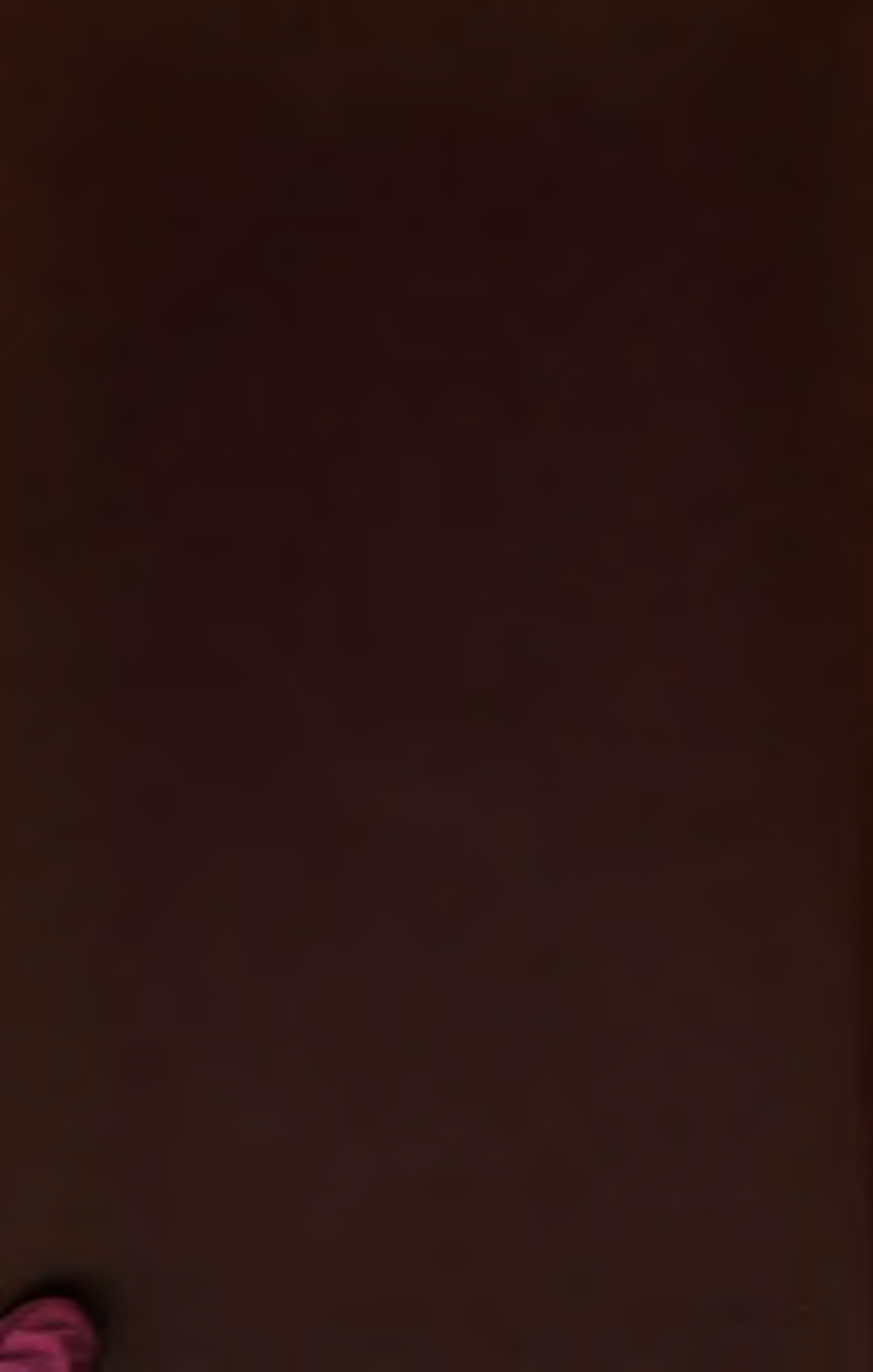
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PROGRESSIVE MEDICINE.

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES,
AND IMPROVEMENTS

IN THE

MEDICAL AND SURGICAL SCIENCES.

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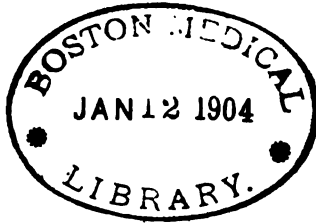
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DISEASES OF DIGESTIVE TRACT AND ALLIED ORGANS: LIVER, PANCREAS, AND PERITONEUM—ANÆSTHETICS, FRACTURES, DISLOCATIONS, AMPUTATIONS, SURGERY OF THE EXTREMITIES, AND ORTHOPEDICS—GENITO-URINARY DISEASES—DISEASES OF THE KIDNEYS—PHYSIOLOGY—HYGIENE—PRACTICAL THERAPEUTIC REFERENDUM.



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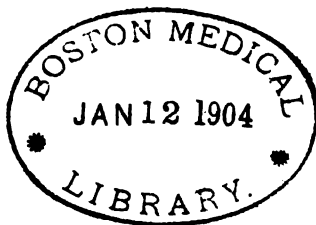
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PROGRESSIVE MEDICINE.

DECEMBER, 1903.

DISEASES OF THE DIGESTIVE TRACT AND ALLIED ORGANS, THE LIVER, PANCREAS, AND PERITONEUM.

By JOHN C. HEMMETER, M.D., PHILOS. D., ETC.

THE STOMACH.

Recent Advances Concerning the Physiology of the Stomach.

The work of Pawlow has shown conclusively that the gastric HCl is the most essential stimulation to the formation of active ferments of the pancreatic juice (no HCl, no or little active ferments in the pancreatic juice). In his masterly research Pawlow discovered a new enzyme in gastric secretion—a specific ferment, *chymaze*—which does not digest food, but which accelerates the action of the ferments of the pancreatic secretion. The digestive tract is not universally and uniformly irritable or stimulatable by every mechanical, chemical, thermic, or dietetic agent, but there is a specific reaction with regard to the peculiarity of every individual digestive demand or duty. There is a most artistic mechanism of digestion revealed by Pawlow's work which in its preciseness and accuracy exceeds any new discovery of modern physiology. If you want to feel proud of being a physician read Pawlow's *Die Arbeit der Verdauungsdrüsen*.

The most efficient means of counteracting *dyspepsia* due to pancreatic insufficiency is to bring about a healthy appetite. Appetite is the stimulus to normal gastric secretion, and this in turn the normal stimulant to healthy pancreatic secretion.

A brief reference to the newer gastric physiology is indispensable, not simply because the stomach is the preparatory organ for intestinal digestion, but also because the chemical processes which various food articles undergo in the stomach are of far-reaching importance for the changes which are to occur in these

foods after they reach the intestines. Many of the older authors, beginning with the American physiologist, Beaumont, believe that the mechanical irritation of the foods cause the gastric secretion, but the experiments in Pawlow's laboratory have proved the fallacy of this view. In the first place, if the secretion were due to simple mechanical irritation, there is no reason why irritation with the point of a glass rod, with a feather, or with sand placed in the stomach should not cause the secretion also.¹ The mistake of the older experimenters, according to Pawlow, grew out of the fact that they ignored the so-called psychic secretion—a secretion which can be set up by the mere smell of food or even by a very intense feeling of hunger. If the œsophagus of the dog is cut, and its end sewed to the edges of an abdominal wound, and at the same time a gastric fistula is established, pieces of meat which are fed to the dog after healing of these fistulae will not reach the stomach, but fall out of the upper end of the fistula leading into the œsophagus. Nevertheless, in five or six minutes after swallowing the food gastric juice begins to be secreted, running from the gastric cannula first in drops and afterward in a continuous stream. If the dog be offered meat without receiving it the gastric secretion will also appear, though not so plentifully as when the dog was actually allowed to eat the meat.

A further interesting phenomenon observed on these dogs was that no secretion followed the swallowing of indigestible substances like small stones. These experimenters, furthermore, elicited the astounding fact that for every kind of food a definite gastric secretion is formed of specific composition. Therefore, we can say that the stomach provides a certain chemical agent to meet each case. We must, therefore, conclude that the mucous membrane of the stomach is capable of distinguishing between the varieties and classes of food that come in contact with it, much as the skin recognizes mechanical, chemical, thermic, and electric stimulation. The question might be asked, "What is the object of this psychic secretion?" for Pawlow has clearly established the existence of two kinds of *gastric secretion*, the *chemical* and the *psychic*. This question applied to the human physiology would be the same as inquiring "What is the object of appetite?" The answer is that under the influence of psychic secretion a gastric juice is furnished which is much more effective than that which is secreted under purely chemical stimulation of the food—i. e., when food is taken without any special appetite. Furthermore, under the influence of psychic secretion foods which otherwise would not stimulate

¹ A secretion can at times be forced by mechanical irritation, but is mostly mucous or a serous liquid, not a gastric juice.

the gastric mucosa to secretion become converted by the already present psychic secretion into something else which constitutes a further stimulant to the secretion of gastric juice. For instance, if a solution of albumen be administered to a dog upon which a Pawlow operation has been performed—i. e., splitting off part of the stomach with all the vessels and nerves intact, and making this second smaller stomach communicate with the external abdominal wall, but not with the general cavity of the large stomach from which it is dissected¹—there will be no secretion from the small stomach, for albumen of itself does not excite chemical secretion; but if the psychic secretion is set up by some other means before the albumen is placed in the large stomach—for instance, by waving a piece of meat before the dog's eyes—then, following the introduction of albumen, a secretion will be found in the small stomach which is qualitatively and quantitatively greater than the psychic secretion alone or when albumen is given alone. It is evident that whilst albumen of itself does not excite secretion, the products of albumen do cause this secretion. The same is true of pieces of bread which when placed in the large stomach through the fistula will not promote a secretion, but if the dog is allowed to swallow the bread secretion commences and continues for several hours. Psychic secretion, therefore, is a preparatory secretion, converting substances which would otherwise not stimulate the stomach into such substances which can accomplish this stimulation. The fact that bread will cause a secretion whenever chewed and swallowed and not when placed directly in the stomach through the fistula may be interpreted, as Pawlow and Peter Borissof do, as proving the secretion of a gastric juice under psychic influence; but, as I will show presently, it may be due to a special ferment in the saliva that stimulates gastric secretion.

Further revelations from Pawlow's laboratory disclose very important relations between the various classes of food, permitting the conclusion that they may mutually advance or interfere with the digestion of their various constituents in the gastric chyme. For instance, starch paste does not of itself promote gastric secretion, but when mixed with meat it was found to accelerate the action of the gastric juice, increasing its digestive power. On the other hand, the addition of fat to a meat diet diminished the quantity of gastric secretion as well as its digestive power. Furthermore, it was demonstrated that the stomach is capable of distinguishing between lactic, butyric, and hydrochloric acids, and responded to each of these acids with a varying quantitative secretion. As lactic and butyric acids are products of gastric fermentation, their

¹ International Clinics, Series XII., vol. ii. p. 276.

stimulating influence on gastric secretion is of therapeutic importance. It is evident, therefore, that the stomach is extremely delicate in detecting not only the composition of foods and regulating the composition of its secretion correspondingly, but that it can distinguish between various organic acids. These experiments, furthermore, gave the clue to the treatment of gastric secretory disorders not by drugs merely, but by dietetic measures.

Methods for Judging the Chemistry of the Stomach; Determination of HCl, Pepsin, Rennin, etc. In almost every case of disease of the stomach it is a *sine qua non* to obtain a clear insight into the state of the gastric secretion, especially the secretion of HCl, pepsin, and chymozin. There is no strict parallelism between peptic strength and the quantity of HCl in gastric juice. The secretion of the pepsin and other ferments and the secretion of HCl are two different and independent processes, which are influences in unequal manner by medical agents (atropine and pilocarpine). On the basis of an extensive analytical material, in which the amount of HCl in human gastric juices was determined by the method of J. Sjökvist, and the concentration of pepsin according to the method of Mette,¹ I used the modification of Mette's method as advised by E. Nirenstein and A. Schiff,² who, in my opinion, have proven very conclusively that Mette's method is not a practical one to determine the pepsin concentration in human gastric juices unless these juices are diluted by sixteen times their volume. I have become convinced that the quantity of pepsin in a gastric juice and the quantity of HCl rarely run parallel, and even in the same normal individual the same amount of HCl does not necessarily correspond to the same amount of pepsin secreted under the stimulation of the identical test-meal on different days. These remarks are sufficient to emphasize that pepsin secretion and HCl secretion are two different things. The stomach, in fact, has in recent years been shown to contain a versatility of secretion which is astounding. No less than seven different products are formed by the gastric mucosa:

1. We have the secretion of mucus by the cylindrical epithelium.
2. The diluting or aqueous secretion, by which it is capable of diluting the gastric chyme in order to reach a certain consistency most favorable for the gastric digestion.
3. The secretion of HCl.
4. Of pepsin.
5. Of chymozin or rennin.
6. Of gastric lipase, the fat-splitting ferment.
7. Of chymaze, the ferment which Pawlow has discovered to be the physiological stimulant accelerating the action of the ferments of the pancreatic secretion—chymaze does not digest food.

¹ Contribution à l'innervation de la glande sous-stomacale, St. Petersburg, 1889. Original in Russian.

² Archiv f. Verdauungs-krankheiten, Band viii. p. 560.

For clinical purposes it is not always practical, even if it were possible, to make quantitative determinations of these varieties of gastric secretions. All of the investigations that were conducted on the physiology of pepsin and trypsin secretion, in the St. Petersburg Institute for Experimental Medicine, by Pawlow, were executed by the aid of Mette's method for determining the concentration of pepsin, and this method I am convinced, after considerable experience with it, is inaccurate and unsatisfactory, even when applied with the modification of Nierenstein and Schiff, to be considered hereafter. The method of Henry W. Bettmann, to be described later, appears to me as being more reliable.

HCl Determination. As before mentioned, the method which has proven most practical and at the same time most reliable for determining the amount of HCl in the gastric juice, has in my experience been that of Sjöqvist.¹ With a few modifications this method is available to determine the total acidity, the combined and free HCl. Right here I must remark that even at the present time there is not one single method for determining the amount of HCl in human gastric juice which is absolutely correct from the chemical standpoint. Accordingly it is fortunate for the clinician that it is not necessary for diagnostic purposes to possess such absolutely correct methods. A certain degree of approximative correctness is sufficient for diagnosis. It is for this reason and also because of the simplicity and practicability that Töpher's method of titrating is still so much in vogue, although it cannot claim to give chemically correct results. The total acidity is, according to this method, determined by phenolphthalein, the free HCl by dimethylamidobenzol, and a third indicator, the alizarin sulphonate of sodium in 1 per cent. solution, is sensitive to all acid factors except the combined HCl. If we accordingly know the total acidity and subtract from it the values obtained by alizarin sulphonate of sodium, we will get as a difference the value of the loosely combined HCl. It is essential to have an accurately standardized decinormal solution of sodium hydroxide for these titrations. I am well aware that dimethylamidobenzol, as it is used in 0.5 per cent. solution, reacts to acid phosphates, and to moderate concentrations of lactic acid. Yet in my experience it is a practical method whenever free HCl is present in the gastric juice at all. Whenever there is no free HCl present the method is unreliable. When free HCl is absent by dimethylamidobenzol I recommend the reagent of Günzberg (phloroglucin, 2 gm.; vanillin, 1 gm.; absolute alcohol, 30).

I have also had an extensive experience with tropæolin 00. On heat-

¹ Zeitschrift f. physiol. Chemie, Band xiii. S. 1.

ing tropæolin in saturated alcoholic solution with gastric juice, pinkish or violet stripes develop on the porcelain dish, which are characteristic for HCl. I consider tropæolin is as sensitive a reagent for HCl as the Günzberg or resorcin tests. It is necessary to emphasize that in order to be as accurate as possible the tests should be conducted with several reagents on the same gastric juice. Phloroglucin-vanillin and resorcin are HCl reagents in the proper sense of the word, and do not react to any other acid.

G. D. Spinneau has invented a so-called *gastro-acidimeter*, by which the total acidity of the gastric contents can be determined in 1 c.c. of the filtrate. The instrument, which is purchasable from Franz Müller, in Bonn, is made of glass, and costs 30 M. As there is no dearth of methods for determining the total acidity, this expensive instrument seems entirely dispensable.

The Quantitative Estimation of the Pepsin ; Determination of the Digestive Power of Gastric Juice. Nothing could be more misleading than the assumption that even the most accurate determination of the amount of HCl secreted would give us an exact insight into the digestive work performed by the stomach. We must not lose sight of the fact that normal proteolysis requires pepsin for its perfect execution, and that HCl alone can bring the proteid no farther than the stage of acid syntonin. And, furthermore, that the different products or constituents of the gastric secretion are expressions of different secretory activities of the glandular parenchyma, and, as has been made probable by the investigations of Pawlow, they can only be evoked by specific dietetic stimulants and in my opinion are each under the influence of a special nervous control. In a publication in the *Medical News*, N. Y., June 7, 1902, on "The Use and Abuse of Digestive Ferments," I described an interesting case in which the amount of free HCl was equal to 60,¹ and yet the pepsin seemed to be reduced, for albumen digestion did not take place satisfactorily until pepsin was added to the digesting mixture.

I have since then studied this same and two other similar cases giving an excessive amount of free HCl by the methods of Hammerschlag and Mette for the determination of the concentration of pepsin. While the amount of pepsin is generally assumed to increase parallel with the amount of HCl secreted, these three cases gave evidence of a disproportion between the increase of the pepsin and HCl secretion. Schwan was among the first to show that an excess of HCl may actually inhibit proteolysis. As the action of ferments is arrested by the presence in excess of their products, this was thought to be one of the causes of

¹ 60 c.c. of $\frac{1}{10}$ normal solution of NaOH to neutralize 10 c.c. of gastric juice.

the inhibited pepsin digestion with excessive HCl secretion. This view is based on the assumption that an excessive HCl secretion goes hand in hand with an excessive secretion of pepsin. It is evident from the case which I have reported in the *Medical News*¹ that reduced pepsin proteolysis may be due to an insufficient amount of pepsin, for when pepsin was added to this gastric juice the digestion of a weighed amount of albumen became normal. It is conceivable that impeded proteolysis may be due as well to an insufficient as to an excessive amount of pepsin. What is needed is a normal pepsin concentration, and this probably varies for each diet and very probably in each individual. I must here emphasize that our methods of determining the concentration of pepsin have up to the year 1902 been very defective; and this explains why so little has been known concerning the exact and normal relations between the quantity of pepsin and the quantity of HCl, and why available practical deductions for diagnosis have not been numerous. It will be necessary for me to go into the consideration of the most recent methods for the determination of pepsin concentration, those of Hammerschlag and Mette; they are of limited practical value for diagnosis, because they are not absolutely accurate.

The physiological digestion of albumen in the stomach is dependent upon a variety of factors, the better known of which are the following: 1. Upon the amount of free HCl. The most favorable amount is equal to 0.2 per cent. of free HCl. 2. Upon the amount of pepsin. The intensity of albumen digestion increases up to a certain limit as the amount of pepsin increases, and it is said to be proportional to the square root of the pepsin concentrations (law of Emil Shütz). 3. Upon the nature and density of the kind of albumen to be digested. Fibrin, which swells up readily, is digested quicker than coagulated egg albumen, and native albumen is digested more readily than coagulated albumen; animal albumen easier than vegetable. 4. Upon the temperature. Gastric juice acts best at a temperature of about 38° to 40° C. At zero the digestion becomes arrested, and at +80° pepsin is destroyed. 5. Upon the presence of the products of albumen digestion. As already stated, all fermentative hydrolytic (catalytic) processes are arrested by the presence of a certain amount of the products of fermentation. The inhibiting influence of the products cannot be removed in artificial digestion experiments, as they can and are during the normal gastric digestion, where a certain equilibrium of relation is maintained between the amount of HCl and pepsin which is continually secreted and the amount of products which are removed either by gastric absorption or by peristaltic expulsion into the duodenum. It

¹ Loc. cit.

is quite certain, also, that the products of albumen digestion can chemically combine with the HCl during artificial digestion experiments to a degree which does not occur in the normal gastric digestion. These difficulties constitute the greatest stumbling block toward the exact experimental imitation of gastric digestion in glass vessels, where we cannot continually keep on adding HCl nor keep on removing the products of digestion. 6. Finally, albumen digestion is dependent upon the presence of certain salts which may prevent the loosening of the proteid to be digested, or they may precipitate the pepsin. Incidentally it should be remarked here that strong concentrations of alcohol may produce these same effects. The presence of small quantities of sodium chloride and phosphates is harmless, but the presence of urates and sulphates is detrimental.

HAMMERSCHLAG'S METHOD OF DETERMINING PEPSIN CONCENTRATION. Take a 1 per cent. solution of egg albumen and add sufficient HCl that it shall contain four per thousand of *free* HCl. (I notice in some text-books and publications that the directions call for 3 to 4 per cent. HCl without stating that the acid should be free.) Measure off two samples each containing 10 c.c. of this albumen solution. To the one 5 c.c. of the gastric juice to be examined is added; to the other, which is used as a control, 5 c.c. of distilled water is added. From each of these samples a definite quantity is poured into each of two Essbach albuminometer tubes up to the mark U. Then the two digesting mixtures are put in the incubator at body temperature for one hour. After this time the tubes are filled with the Essbach reagent up to the mark R. Each tube is tightly corked and allowed to stand twenty-four hours at room temperature after shaking them by inverting them several times. After this the height of the sediment can be read off in both tubes. The control tube, to which nothing but water has been added, shows the original percentage of albumen of the mixture, and the difference in the sediment of this tube and the second tube to which gastric juice has been added is equal to the amount of albumen that has been digested. According to Hammerschlag's statement, between 80 and 95 per cent. of albumen is digested in this manner by the gastric juice from healthy individuals.

METTE'S METHOD FOR DETERMINING PEPSIN CONCENTRATION. The white of fresh hen-eggs is drawn up in fine glass tubes having a lumen of 1 mm. to 2 mm. This egg albumen is coagulated at a temperature of 95°. From these albumen tubes pieces are cut out 2 cm. long, placed in porcelain dishes, and covered with the gastric juice to be tested. These digesting mixtures are placed in the thermostat for twenty-four hours.

Nierenstein and Schiff¹ have shown that the digestion is fairly uniform during twenty-four hours. Accordingly the amount of the albumen column digested in twenty-four hours is twice as large as that digested in twelve hours. The amount of coagulated albumen digested in the little glass tubes is measured by a steel scale graduated in 0.1 mm.; an enlarging lens or dissecting microscope is advantageous for this purpose. According to the law of Borisow,² the lengths of the albumen columns digested bear the same relations to each other as the square roots of the pepsin concentration. In other words, the pepsin concentrations are in proportion to the square of the millimetres of the albumen columns digested. For instance, if 2 mm. and 3 mm. of albumen columns are digested in two solutions respectively, the relative amount of pepsin are to each other as 4 is to 9 (not as 2 is to 3).

Of these two methods Mette's gives more exact results than Hammerschlag's, though both methods are not as exact as we have a right to demand, for with standard albumen solutions of known strength they both give variable and incorrect results.

The chief defects of Hammerschlag's method are : 1. The Essbach method which it makes use of is itself notoriously inaccurate. 2. The picric acid solution precipitates not only the albumen, but also the peptones and albumoses. 3. The test requires twenty-four hours. Mette uses capillary tubes filled with coagulated egg albumen. He lays pieces of such tubes in the juice to be examined and estimates the digestive power of the juice by the amount of the albumen digested after ten hours. As ordinarily made with undiluted gastric juice, this method is entirely unreliable. In weakly digesting or diluted gastric juices the technical errors may amount to from 10 to 30 per cent.

A new method of determining the digestive power of gastric juice, suggested by Dr. Henry Wald Bettman,³ is as follows : A circa 0.75 per cent. solution of albumen containing 0.2 per cent. free HCl is used ; 10 c.c. of this solution is mixed with 5 c.c. of the gastric juice, brought in certain cases to an acidity of 0.2 per cent. The mixture is placed in the incubator at 37° C., a control solution mixed with 0.2 per cent. HCl accompanying it. After exactly one hour the two tubes are removed, the albumen is precipitated with a 10 per cent. solution of trichloroacetic acid, and the tubes centrifugalized in a high-speed centrifugal machine. The difference in volume of the two sedi-

¹ Archiv f. Verdauungs-krankheiten, Band viii. p. 569.

² This law was not original with Borisow, but was discovered in 1895 by Emil Schütz, A Method for Determining the Relative Pepsin Concentration. Zeitschrift f. physik. Chemistry, 1895, Band ix.

³ American Gastro-enterologic Association, May 14, 1903.

ments gives the amount of albumen digested. The test can be completed in two or three hours. The range of error is very small.

When the albumen digested is determined according to the method of H. W. Bettman or A. L. Benedict, and on the same specimens the amount of free and combined HCl is determined, it will be found that the presence of free HCl in a gastric juice does not by any means mean that this gastric juice digests well. I have personally reported cases of excessive hyperchlorhydria where the albumen digestion was under the normal. I do not think that this discrepancy is due to any defect in the methods employed, but that it suggests that the pepsin secretion and HCl secretion are two entirely different things, and that one secretion may be abnormally increased at the same time that the other is abnormally diminished. There is room for individual interpretation of this discrepancy, however, and it may be that the proteolysis in hyperchlorhydria, which is at first rapid, may be later on arrested by its own products.¹ In some of the cases which I have studied in this way, however, the proteolysis was resumed in the digesting mixtures after I had added very small quantities of pepsin. This would suggest, of course, that there are rare cases in which pepsin has a distinct field of therapeutic usefulness, and that we are justified and logical in adding it to gastric digestion of such cases in which a disproportion can be established between the amount of free HCl and the amount of pepsin concentration. Such an indication for pepsin is very rare, and can only be ascertained by repeated and painstaking analyses.

Gastritis. A case of diffuse *phlegmonous gastritis* is reported by Lengemann² which was cured by operation, thus confirming my predictions given years ago³ that the only correct way to treat such cases is by operation.

Gastric Ulcer. There have been no noteworthy advances in our knowledge of the pathogenesis of peptic ulcer since the publication of the experiments of B. Fütterer.⁴ The essential point of these investigations was that experimental gastric ulcers in animals would, as a rule, heal very promptly unless the hæmoglobin was destroyed by the injection into the circulation of pyrogallie acid. The disorganization of the hæmoglobin, therefore, is one of the conditions for the maintenance of gastric ulcer, and the treatment must be directed toward keeping up the hæmoglobin to the normal standard. This is done by the administration of beef-juice according to the method of Fütterer,⁵

¹ Hemmeter. *Diseases of the Intestines*, vol. i. pp. 114-116.

² Mitteilungen aus d. Grenzgebieten d. Med. u. Chir., Band ix., Heft 4 und 5.

³ Hemmeter. *Diseases of the Stomach*, 1st edition, 1897.

⁴ PROGRESSIVE MEDICINE, December, 1902, vol. iv.

⁵ Ibid., p. 32.

which, in my experience, is indeed efficacious as long as the patient does not develop a repugnance against this preparation. Where the patient finally objects to this diet I have sometimes succeeded with high enemas of ferratin.

In connection with the dietetic treatment of gastric ulcer a few remarks are necessary which are applicable to the dietetic management of all irritative states of the gastric mucosa. Modern researches have confirmed the view that the digestive work of the stomach consists only in the mechanical and to a certain extent chemical disintegration, and not in the solution of the food. This gives the keynote for the dietetic management, viz., all foods should be given in so extremely finely divided a state that the large part of the work is spared to the sick stomach. As the stomach must dissolve the connective tissue in the meat (the pancreas and intestinal juice having no power to dissolve connective tissue), normal intestinal digestion can only take place after the connective tissue has been disorganized in the stomach. It is, therefore, advisable not to give raw meat in gastric ulcer, as some have suggested, but to give it after it has been thoroughly boiled and finely cut up before it is placed in the mouth. As raw meat is a strong stimulant to the secretion of gastric juice,¹ it must be avoided in gastric ulcer, all forms of gastritis with an excessive amount of free HCl, and in hyperchlorhydria. Of course, the same effect might be produced by the extractive substances of the meat. Schmidt² in recommending a carbohydrate diet in hyperacidity placed himself upon the standpoint which the writer first established experimentally in 1896, viz., that the amount of HCl secreted by the stomach can be reduced by a persistent carbohydrate diet, provided there is no stagnation or gastric fermentation.³ From recent dietetic studies the conclusion is justifiable that rest, absolute exclusion of food for periods varying from twenty-four to forty-eight hours, is one of the most helpful means of recuperating the stomach from all irritative gastric conditions. Similarly, if the gastric secretion is depressed or arrested a diet containing raw scraped beef and beef extract appears logical to stimulate the dormant secretive powers.

The medicinal treatment of gastric ulcer has not been much advanced in recent publications on the subject. Fleiner⁴ repeats his recommendation of the treatment of gastric ulcers by means of large doses of bismuth combined with alkaline mineral waters. He gives 5 gm. to

¹ Pawlow. *Die Arbeit der Verdauungsdrüsen.*

² Beiträge z. Diätotherapie bei Magen- und Darmkrankheiten. *Münchener med. Wochenschrift*, Nos. 6, 7.

³ Hemmeter. *Archiv f. Verdauungs-krankheiten*, Band iv. p. 23.

⁴ Therapie der Gegenwart, No. 11.

10 gm. (75 gr. to 150 gr.) of bismuth subnitrate in water, which the patient drinks, and increases the dose up to 20 gm. (300 gr.). Unfortunately, such doses of bismuth inevitably cause persistent constipation. This is the objection also to Pariser's treatment.¹ My personal preference, based on a large experience, is to neutralize the gastric contents before breakfast by washing it out with a solution of bicarbonate of soda in which 2 drachms of finely divided chalk are suspended. After this a mixture of equal parts of bismuth subnitrate and bismuth subgallate are allowed to run into the stomach through a stomach-tube, 2 drachms of the mixture in 500 c.c. or half a pint of warm water. By proper movements the patient must attempt to get the bismuth over all parts of his stomach; it is allowed to remain in the stomach for two or three minutes and then siphoned out. No meal is then taken for two or three hours, the patient subsisting on a Boas rectal enema in the morning. In *Therapie der Gegenwart*, 1902, No. 2, P. Cohnheim repeats his recommendation of the use of large doses of olive oil in the treatment of gastric ulcer. Fleiner² also washes the stomach with a 1 or 2 per cent. solution of nitrate of silver. Ageron³ and the writer have had satisfactory results with a combination of the olive oil and bismuth subnitrate. About half a pint of cottonseed or olive oil are thoroughly shaken with 2 drachms of bismuth subgallate and allowed to run into the stomach through a stomach-tube. The patient then occupies the dorsal, lateral, and ventral positions in order to spread the bismuth and oil over the entire internal surface of the stomach.

FERRILE ATTACKS DURING GASTRIC ULCER. These are described by A. Strasser.⁴ An explanation of this kind of fever is not given.

THE SURGICAL TREATMENT OF GASTRIC ULCER is considered in the section on Abdominal Surgery by William B. Coley. The latest views on the subject can be found in *PROGRESSIVE MEDICINE*, June, 1903, p. 67.

THE TREATMENT OF GASTRIC HEMORRHAGE. In hæmatemesis Cerac⁵ has obtained good results from the subcutaneous injection of gelatin solution when all other hæmostatic procedures failed. Grunow⁶ reports similar success. I have had personal experience with this method. A 2 per cent. of sterile gelatin solution warmed to body temperature was injected in quantities varying from 150 c.c. to 200 c.c. The patient had lost about a pint and a half of blood by hæmatemesis. The result was such as to encourage me in the further use of this method should opportunity offer.

¹ *PROGRESSIVE MEDICINE*, 1902, vol. iv. p. 31.

² *Münchener med. Wochenschrift*, 1902, Nos. 22-24.

³ *Ibid.*, No. 30.

⁴ *Wiener klin. Rundschau*, 1902, No. 10; also, *Wiener med. Presse*, 1902, Nos. 19, 20.

⁵ *Le mois thérapeutique*, 1902, vol. xiii., No. 2.

⁶ *Berliner klin. Wochenschrift*, 1902, No. 32.

A case of *parenchymatous gastric hemorrhage* is described by Moser¹ which seemed to be due to chronic hyperplastic gastritis. A large number of operations for gastric ulcers are described in American, English, and German literature of the past twelve months, and the favorable results would indicate that this method of procedure is the correct one; but as it does not belong within the limits of a clinical report, the surgical treatment of this disease must be referred to another section of this work.

Cancer of the Stomach. Concerning the etiology of cancer of the stomach, the research of G. Fütterer² has been given in *PROGRESSIVE MEDICINE*, 1902, Vol. IV. p. 35. Fütterer describes the development of an adenocarcinoma at the edges of experimental gastric ulcers in rabbits. His research can, therefore, throw light only upon this type of gastric cancer, and not upon the colloid, the cylindrical cell, or the scirrhus carcinoma. How frequently a carcinoma develops on the edges of a gastric ulcer is difficult to determine with accuracy, for this depends upon a searching histological examination of the cancer, and it is regrettable to state that in the reports from operations and autopsies there is rarely a histological examination, and even if there is one it is not undertaken with a view of determining the histogenetic derivation of the cancer. The greatest importance attaches itself to the researches concerning the pathogenesis of gastric cancer, because *the stomach is the organ most frequently affected by cancer*, and because the treatment of this dreadful disease can be advanced only by a better understanding of the nature and cause of malignant neoplasms. In this connection I have emphasized the hopefulness of a study of the cancer problem from the chemical and physical standpoint.³ While I do not assert to have produced actual adenocarcinoma, my experiments are suggestive because adenomata were produced at the edges of pre-existing gastric ulcers by the injection of a sterile and cell-free extract of a gastric adenocarcinoma from another animal of the same species. The behavior of cancer cells in solution isotonic with the blood cells and of normal cells of the same tissue in cancer juice, the former contracting in solutions isotonic with the blood plasma and the normal cells swelling up in cancer juice, indicate that there are distinct abnormalities in growth depending upon the physical condition inherent in the cell and not necessarily upon an invading micro-organism. I have also pointed out that the serum of cancer patients may contain anticarcinoma substances capable of destroying the carcinoma cells to a large extent, at

¹ Münchener med. Wochenschrift, November 4, 1902.

² Journal of the American Medical Association, March 15, 1902.

³ On the Role of Intracellular Catalytic Processes in the Pathogenesis of Malignant Neoplasms. American Journal of the Medical Sciences, April, 1903, p. 666.

least as long as the circulation is not overcrowded with this cellular infection. It is conceivable that the diagnosis of cancer may be made in future by the reaction which the serum of a cancer patient may show in its effect upon the normal cells of a healthy individual. By this I do not refer to the blood cells, but cells from the normal organ corresponding with the one which is diseased in the cancer patient. That all adenomata which grow from the edge of a gastric ulcer are not malignant is evidenced by a case reported by Albu,¹ in which a palpable benign tumor of the stomach was removed by operation. It was a simple glandular hypertrophy developing from an old cicatrix.

BEHAVIOR OF THE CHLORIDES IN THE STOMACH AND THE CAUSE OF THE ABSENCE OF HYDROCHLORIC ACID IN GASTRIC CARCINOMA. Some clinicians believe that in cancer of the stomach less HCl is secreted because the oxyntic or acid-producing cells of peptic ducts are diseased or destroyed by the neoplasm or by the accompanying gastritis; others are of the opinion that HCl is still secreted but is destroyed by substances contained in the carcinomatous stomach. Reissner² believes, since free HCl may be absent at a very early stage and can reappear after the removal of the cancer, it must follow that the cause of the absence of the acid is removed with the carcinoma, and that the glandular atrophy is only secondary. Reissner's examinations of cancer patients have, moreover, shown that the total chlorides are relatively high, due to an increase of the combined chlorides. The chlorides found in the stomach are derived from the following sources: 1. The neutral chlorides of food and saliva. 2. The free HCl secreted by the gastric glands and that combined with albumins. 3. The combination of chlorine with ammonia. Reissner believes that the total chlorides are increased because a portion of the secreted HCl is neutralized by an alkali derived from the fluid discharged from the ulcerating surface of the carcinoma, and which in itself possesses a large amount of chlorine. He states that a cancer produces changes in the chemistry of the gastric secretion only after it has ulcerated, and that the free HCl is absent because its actually secreted amount is diminished and the existing quantity has been neutralized by the alkali mentioned. The cause for both is ulceration of the cancer.

The objections to the theory of Reissner and others are very weighty. In the first place, there can be no doubt that the oxyntic cells are seriously damaged and often destroyed in cancer. Second, removal of the cancer by surgical operation does not always restore the secretion of HCl; in fact, it only does so exceptionally. Among the thousands of operations

¹ Deutsche med. Wochenschrift, 1902, No. 48, p. 865.

² Zeitschrift f. klin. Medicin, 1902, Band xlv. p. 71.

done for cancer of the stomach reported in literature I know of only four in which the operators claimed that a restoration of the HCl secretion had been observed. These are the cases of Rosenheim, Thiers, Terrier and Hartmann, v. Mikulicz, and Kausch. Boas mentioned that he has also observed the restoration of the HCl secretion. Evidently this restoration must be a very rare occurrence. Third, it is not necessary for a carcinoma to ulcerate in order to destroy the HCl secretion, as Reissner says, for this secretion has been repeatedly found lost where the carcinoma had not yet been broken down. I have personally observed it lost in three cases of scirrhus of the stomach without any visible ulceration. Fourth, there is a form of gastric carcinoma that develops on the basis of a pre-existing ulcer in which the HCl secretion is not only maintained to the end of life, but may even be increased. A theory that attempts to explain the absence of HCl on the basis that an ulcerating carcinoma produces something which neutralizes the secreted HCl should be applicable to all forms of ulcerating carcinoma of the stomach. We do not exactly know why the HCl secretion is maintained in *ulcus carcinomatosum*, but it is probable that the oxyntic cells acquire a stronger resistance and a higher development during the hyperchlorhydria which, as a rule, accompanies the peptic ulcer on the base of which the carcinoma later on develops, and as the peptic ulcer was associated with hyperchlorhydria, it is reasonable to presume that the subsequent *ulcus carcinomatosum* may for a long time be associated with an exaggerated functional activity of the acid-producing cells. Fifth, those that adhere to the hypothesis that the cancer could secrete or contain something which could neutralize or destroy the secreted HCl assume, of course, that the HCl is secreted in the normal amount, for it is part of their hypothesis that the oxyntic cells are not or very slightly diseased, and still capable of functioning. They have entirely overlooked the fact that it would require enormous quantities of an alkaline material to neutralize the HCl secreted, for the amount of HCl calculated on two parts per thousand of 600 c.c. gastric juice would, according to Michael Foster, be 12 grammes of absolute HCl or 36 grammes of strong liquid HCl. I have in 3 cases minced up and extracted the entire gastric carcinoma under aseptic conditions, and found that a carcinoma weighing very nearly 100 grammes could not combine with or neutralize more than 4.5 grammes of liquid HCl. Emerson¹ has found that carcinomatous tissue contains substances which can bind HCl, and that the addition of fresh carcinomatous tissue to an artificial digesting mixture will effect a more rapid combination with the HCl. This ceases when the

¹ Archiv f. klin. Med., Band lxxii. p. 415.

mixture is heated to 100° F. Emerson assumes the presence of a ferment in the carcinoma tissue which can digest albumen in the incubator as well as in the human stomach. In his experiments the possibility is not excluded that the ferment he speaks of may be pepsin, for, as is well known, pepsin is frequently secreted when the HCl secretion is entirely absent. In order to make the conclusion unassailable such digesting mixtures must be made entirely sterile, for the bacterial proteolysis is considerable. That there are autolytic ferments in gastric and other carcinomata there can be no doubt, but that such ferments have marked proteolytic power in the presence of HCl is to my mind not yet clearly proven, and seems irreconcilable with the well-known fact that the proteolytic power of the gastric secretion in carcinoma of the stomach is, as a rule, far below the normal (Hammerschlag, Riegel, Ewald, Boas, Fleiner, and others).

HÆMATOLOGY IN THE DIAGNOSIS OF CANCER OF THE STOMACH. Mouisset and Tolot¹ studied the blood in eight cases of cancer of the stomach with the Hayem hæmatimeter and the hæmochromometer of Malassez. Their findings are not of decided diagnostic value, for they find that the diminution of the number of red corpuscles is proportionate to the general health of the patient. The ratio of the hæmoglobin percentage to the red corpuscle percentage—that is, the diminution of the globular value—may be a significant sign of cancer in the stomach; but it may be absent owing to the slow development of the lesion. Leucocytosis is a late phenomenon, and does not appear until the period of cachexia, or as a result of intervening inflammatory complications.

In previous reports on the subject significance has been attributed to leucocytosis in its various fluctuations for the diagnosis of gastric cancer, but these observers state that definite deductions from the kind of leucocytosis are not possible. This is in agreement with my own interpretation that not all cases of gastric carcinoma show a leucocytosis and that the digestive leucocytosis is not absent in all cases of gastric cancer.

The surgical treatment of cancer does not properly belong within the limits of this report.

Stiller's Pathognomonic Sign of Gastropotosis, the Floating Tenth Rib, has received the careful study of W. Zweig and B. Stiller.² The essential deductions are that this sign really is valuable in the diagnosis of nervous dyspepsia. Stiller is also very impressive in defending his original assertion that nervous dyspepsia and enteropotosis

¹ Revue de médecine, 1902, p. 844.

² Archiv f. Verdauungs-krankheiten, Band vii.

are identical in the large majority of cases, and that the tenth rib is floating and not attached to the costal cartilage in the great majority of these cases. I have paid especial attention to this sign, and in the main can confirm Stiller's conclusions. All cases of gastropotosis that I have seen at my clinic and private practice during 1902 had this floating tenth rib. I cannot support the conclusions of Kuttner¹ that a splashing sound at the height of digestion means gastric atony. This sound can be elicited in healthy individuals if the diet contained much liquid. It certainly is not true that splashing sounds elicited a quarter of an hour after drinking a half a pint of liquid signifies a pathological condition of the gastric tonicity, as A. Rosenbaum asserts.² Perhaps the most important advances in the treatment of *dilatation* and *gastropotosis* have been made in a surgical direction. Most noteworthy of these advances is the operation by Henry D. Beyer.³ The principle of this operation is considered histologically and surgically ideal. Some cases are reported in which the patients have secured complete relief. My standpoint concerning the necessity of operation for gastropotosis is this: a stomach may be out of place and still digest normally. Among my fifty students, four who were perfectly healthy had gastropotosis, and presented no symptoms. Furthermore, even in those cases which did give rise to symptoms medical treatment is perfectly competent to effect lasting improvement and sometimes a cure; whereas surgical treatment, although cures are conceded to be possible, can by no means confidently guarantee a recovery. A. E. Maylard,⁴ in an interesting paper, emphasizes "The Value of Rest as Effected by Operations in Diseases of the Alimentary Canal." While I agree with him concerning the value of operation in gastric ulcer, pyloric stenosis, chronic ulcerative colitis, and dilated colon, I am of the opinion that he goes too far when he advises gastrojejunostomy for hyperchlorhydria and chronic gastritis. These diseases are perfectly curable by purely medical means.

Neuroses of the Stomach. Although over three-fourths of all gastric diseases as they present themselves to the practitioner are comprised under the group of "neuroses," very little of value has been published concerning this important class of gastric diseases during the past year. In the preceding I have already emphasized that which is of diagnostic and therapeutic importance concerning the differentiation of gastric diseases with a distinct anatomical substratum and the gastric neuroses without any histological change in

¹ Berliner klin. Wochenschrift, 1902, No. 50.

² Deutsche med. Wochenschrift, No. 25.

³ The Elevation of the Stomach in Gastropotosis by Plication of the Gastrohepatic and Gastrophrenic Ligaments. Philadelphia Medical Journal, February 7, 1903.

⁴ Glasgow Medical Journal, November, 1902.

the stomach. In this connection it was emphasized that future researches will more and more demonstrate that some of the neuroses will be found to be associated with definite histological changes in the gastric mucosa. This constitutes one of the difficulties in nomenclature in designating stomach diseases, according to the character and amount of secretion found. From what has been said in the preceding, for instance, it by no means follows that hyperchlorhydria is always associated with excessive proliferation of the oxyntic or acid cells, nor that achylia gastrica is invariably associated with atrophy of the gastric mucosa. The relation between achylia gastrica and pernicious anæmia are discussed by Einhorn,¹ in which he emphasizes that most cases of achylia have nearly a normal condition of the blood. In one case of achylia with total atrophy of the stomach pernicious anæmia did not exist during life. He confirms the observation already made by myself and others that gastric juice may be secreted in typical cases of pernicious anæmia, sometimes even in excessive amount, and he points out that if pernicious anæmia were caused by atrophy of the stomach the achylia would have to be well marked as soon as the symptoms of the blood disease are evident.

... **Heterochylia.** In 1897² I first pointed out that a rapidly alternating state of gastric secretion may occur in patients afflicted with nervous dyspepsia, whose stomachs were of normal size, in normal condition, and not afflicted by any of the anatomical diseases. These variations may extend from complete achylia to hyperchlorhydria in the same individual after the identical test-meals and under the same conditions. It is important to exclude dilatation and motor insufficiency in such cases. Dr. George Korn,³ in a research from Boas' laboratory, Berlin, confirms my observation, which had already been confirmed by Frank H. Murdock.⁴ I have personally observed cases of achylia gastrica off and on for six years, one case for six years and eight months, in which no trace of free HCl and ferment was found in many quantitative analyses. Finally, a test-meal was drawn which gave a normal or excessive amount of HCl and ferments. It is evident that such cases cannot depend on atrophy of the gastric mucosa. It may be that the oxyntic or border cells are innervated by a different set of fibres from those innervating the chief or central cells; or it may be that both these cells are supplied by both anabolic and catabolic fibres, in the sense of Gaskell, *i. e.*, accelerating and inhibiting fibres; or it may be that the enzyme body which I have discovered in the saliva and which

¹ New York Medical Record, February 28, 1903, p. 321.

² Hemmeter. *Diseases of the Stomach*, first edition.

³ Archiv f. Verdauungs-krankheiten, Band viii. p. 75.

⁴ New York Medical Journal, 1900, and Philadelphia Medical Journal, 1900.

seems to be a normal stimulant to the gastric secretion may at times be absent in such patients. This new body is not always present in the saliva and is most constant when there is a good appetite.

Gastric Lipase, the Fat-splitting Ferment of the Stomach. Volhard¹ has demonstrated that a fine emulsion of almost neutral egg and milk fat is split up by the secretion of the stomach into fatty acids and glycerin. About 70 per cent. of the fats introduced are split up in this way. Further facts about this ferment are the following: 1. It is contained in a glycerin extract prepared from the gastric mucosa of the pig. 2. When gained from the secreted gastric juice, gastric lipase is more sensitive to alkalies than when lipase is gained from a glycerin extract of gastric mucosa. 3. The former is more resistant to HCl than the latter. 4. The gastric juice containing the active fat-splitting ferment, the glycerin extract its proenzyme of zymogen. 5. The digestion of fat by gastric lipase apparently does not increase proportionately with the chyme, but is performed in irregular intervals. 6. The reaction is incomplete; only a certain percentage of the fat is acted on. 7. In achylia gastrica this ferment is diminished, together with the other ferments in the stomach. 8. High degrees of hyperacidity interfere with the action of gastric lipase.

DISEASES OF THE INTESTINES.

Influence of Intestinal on Pancreatic Secretion. A valuable contribution to the relation between intestinal digestion and the mechanism of pancreatic secretion is published by W. M. Bayliss and E. H. Starling.²

Their conclusions are that: 1. The secretion of the pancreatic juice is normally evoked by the entrance of acid chyme into the duodenum, and is proportional to the amount of acid entering (Pawlow). This secretion does not depend upon a nervous reflex, and occurs when all the nervous connections of the intestine are destroyed.

2. The contact of the acid with the epithelial cells of the duodenum causes in them the production of a body (*secretin*), which is absorbed from the walls of the blood current, and is carried to the pancreas, when it acts as a specific stimulus to the pancreatic cells, exciting a secretion of pancreatic juice proportional to the amount of secretin present.

3. This substance (*secretin*) is produced probably by a process of hydrolysis from a precursor present in the cells, which is soluble in water and alkalies, and is not destroyed by boiling alcohol.

¹ Zeitschrift f. klin. Med., Band xliii. p. 397.

² Journal of Physiology, September 12, 1902, vol. xxviii. p. 325.

4. Secretin is not a ferment. It withstands boiling in acid, neutral, or alkaline solutions, but is easily destroyed by active pancreatic juice or by oxidizing agents. It is not precipitated from its watery solution by tannic acid or alcohol and ether. It is destroyed by most metallic salts. It is slightly diffusible through parchment paper.

5. The pancreatic juice obtained by secretin injection has no action on proteids until "enterokinase" is added. It acts on starch and to some extent on fats, the action on fats being increased by the addition of succus entericus. It is, in fact, normal pancreatic juice.

6. Secretin rapidly disappears from the tissues, but cannot be detected in any of the secretions. It is apparently not absorbed from the lumen of the intestine.

7. It is not possible to obtain a body resembling secretin from any tissues of the body other than the mucous membrane of the duodenum and jejunum.

8. Secretin solutions from bile salts cause some increase in the secretion of bile. They have no action on any other glands.

9. Acid extracts of the mucous membrane normally contain a body which causes a fall of blood pressure. This body is not secretin, and the latter may be prepared free from the depressor substance by acting on desquamated epithelial cells with acid.

10. There is some evidence of a specific localized action of the vasodilator substances which may be extracted from various tissues.

Enterokinase, Eukinase, Pancreatokinase. Succus entericus, as well as the saline extract of duodenal mucous membrane, contains a body called "enterokinase," which was first investigated in Pawlow's laboratory by Chepowalnikoff.¹ The pancreatic juice, which is obtained by the action of the duodenal secretin discovered by Bayliss and Starling, is inactive upon proteid (boiled white of egg and gelatin) until it has been acted upon by enterokinase. A complicated but admirable interdependence of the pancreatic and duodenal secretions here becomes evident. 1. The contact of the HCl of the gastric chyme with the epithelial cells of the duodenum causes in them the production of a body called "secretin," which is absorbed from the cells by the blood current, is carried to the pancreas, where it acts as a specific stimulus to the secretion of pancreatic juice, which is proportional to the amount of secretin present. 2. This pancreatic juice, however, though active upon boiled starch, is not active upon proteid until enterokinase is added—another product of the duodenal and jejunal mucosa.

Hallion and Carrion² have extracted from the duodenal mucous membrane of the pig a yellowish powder which contains the entero-

¹ Thèse de St. Petersburg, 1899.

² Bulletin de générale de thérapeutique, 1903, vol. cxlv., No. 2, p. 53.

kinase of Pawlow in very active form. They have called this duodenal extract *eukinase*, and have recommended it in acute and chronic affections of the intestines, either of primary origin or secondary to infectious diseases. In intestinal dystrophia it is also of great value. Pancreato-kinase is a combination of pancreatin and eukinase, which is also claimed to be a powerful intestinal digestant. These substances, it is stated, are acted upon by gastric juice, which hinders their usefulness. In cases of achylia gastrica, where as a consequence of the absence of the secretion of HCl and pepsin the normal physiological stimulants to the secretion of *secretin*, and consequently of pancreatic juice and enterokinase, are lacking, we are confronted with a complication where both the gastric and intestinal digestive process is gravely defective. In such cases the beef and even fats and carbohydrates may appear in the stools undigested. It is here that the restoration of the normal gastric secretion is the most essential aim of the treatment. Sometimes the addition of thirty to sixty drops of dilute HCl is sufficient to start up the formation of secretin if an enteritis is not present at the same time. Should we, however, be confronted with a simultaneous duodenitis or jejunitis, then we will not be able to set up the formation of secretin unless the intestinal mucosa can be restored to a normal condition. In these complications the extracts of the duodenal mucosa, mentioned in this paragraph, constitute the physiological therapeutics. Care should be taken, however, by the examination of the stools, to see whether or not these substances actually improve the digestion.¹ In associated gastric and intestinal catarrh I have found that pancreon actually improved intestinal digestion as controlled by stool examination. It is one of the preparations belonging to the class mentioned above that has the advantage of not being destroyed by the HCl of the gastric juice. The above researches of Bayliss and Starling and those coming from Pawlow's laboratory demonstrate the fallacy of such statements as that made by Edkins,² who gravely announced that he was unable to demonstrate experimentally the existence of an intestinal secretion.³

Ponomarew⁴ has discovered that there is a secretion of Brunner's glands which digests albumin and fibrin when HCl is added.

Absorption from the Stomach. The experiments on absorption thus far reported have shown that water is not absorbed from the stomach, and that there exists great variation in the absorption of

¹ Hemmeter. Use and Abuse of Digestive Ferments, Medical News, June 7, 1902.

² British Medical Journal, September 13, 1902.

³ Modern medical literature is full of publications of this sort, announcing the most contradictory discoveries, which, upon critical judgment, are found to be due to some error of technique or faulty deduction.

⁴ Zur Physiologie der Brunner'schen Abteilung des Duodenum. Russki Wratsch., No. 46.

such chemical substances as we use for the relief of suffering and cure of disease. *Nothing can be more relevant than the necessity that we should be sure, at every step of our treatment of any case, that the medicine which we give and upon which life may depend is actually absorbed.* I have frequently been called to cases of complication of valvular disease of the heart with gastric dilatation where the symptoms of failure of compensation were due to the fact that the digitalis and strychnine which had been given remained in the dilated stomach and were not absorbed. In all cases of serious heart trouble with chronic gastritis or dilated stomach the digitalis and strychnine should be given hypodermically or by enema into a previously cleansed rectum.

Since the investigations of Meltzer¹ the most valuable researches on gastrointestinal absorption have been made by V. Otto.² This experimenter worked over the results of von Mering on several types of animals—guinea-pigs, rabbits, cats, and dogs—and with a number of different chemical substances (iodide of potassium and sodium, sodium salicylate, chloral, strychnine nitrate). The remarkable result was gained that there are considerable differences in the absorption of these individual substances in the same animal, and that the absorption of these substances varies in the different animals experimented upon. For instance, the small molecule of KI is absorbed readily from the gastric mucosa of the herbivora, while the large molecule of strychnine is not absorbed by these stomachs. On the other hand, the gastric mucosa of the carnivora opposes a very considerable resistance to the absorption of the ordinary diffusible molecule of KI and NaI, while it permits the molecule of strychnine nitrate to pass readily. The deduction which we are justified in making therefrom is that we must not judge from the absorbability in the stomach of one substance concerning the absorbability of a different substance, and, secondly, that the power of absorption of one species of animal cannot be applied to another species or to the human being, as von Mering does. Personally I very much regret that neither the experiments of Otto nor any of the others quoted permit of judging whether sodium salicylate is absorbed from the human stomach. By methods which I demonstrated years ago it is possible temporarily to occlude the human duodenum by blowing up a small pear-shaped balloon in it which is introduced by duodenal intubation.³ In this manner it would be not difficult to test the absorption of various important drugs from the human stomach, and it is here where a field of research of far-reaching importance is open for the brainy investigator. Even concerning the absorption of

¹ Journal of Experimental Medicine, 1896, vol. i.

² Archiv f. Verdauungs-krankheiten, 1902, Band viii.

³ Hemmeter. Diseases of the Intestines, vol. i. p. 284.

the normal products of gastric digestion a great deal of work has yet to be done. In a recent publication by E. Zunz¹ it is stated that of the products of albumen digestion that are formed in the stomach the albumoses are formed very abundantly, the acid albumen less abundantly, and the remote products of digestion, like peptones and peptoids (the latter being precursory stages of amido-acid) are formed in very small quantities. The greatest part of the soluble products is given over to the small intestine, rapidly split up, and absorbed. In the stomach the absorption is rather small. The remote products of digestion are first absorbed—peptones, etc.—then to a less degree the albumoses. The remote products, like peptones and peptoids, are present in the stomach only in small quantities, and, therefore, their absorption has but small significance. The substances which no longer give the biuret reaction are those which are principally absorbed from the stomach. The absorption of albumoses is not excluded, however, because their presence can be demonstrated in the wall of the intestine.

The Special Pathology of the Intestine. The special pathology of the intestine will be considered in connection with the diseases concerning which something new of real merit can be reported. But inasmuch as intestinal autointoxication depends on the quantity and quality of the bacteria present, this subject will merit special attention. Klein² concludes that nowhere in the normal intestine does an augmentation of the bacteria occur, and that there is no bacterial flora peculiar to the intestines. All bacteria are derived from the food, and the bacteria die off and decrease continually. This destruction of bacteria is strongest in the cæcum, appendix, and ascending colon. The colon bacteria are very resistant, and wherever there is an increase of bacteria this is to be attributed to a reduction in the antibacterial provision of the intestines and a pathological condition. As the bacteria are continually decreasing in number, a continual destruction of them taking place, Klein does not attribute to bacteria a rôle in the digestive act.

The Permeability of the Juvenile Intestinal Wall for Tubercle Bacilli has been investigated by Disse,³ who explains the ability of tubercle bacilli to pass through the intestinal wall in youthful individuals by the fact that the protoplasm of the epithelial cells is not yet covered by a continual stratum of mucus. Only here and there single plugs of mucus project from a protoplasmic network. As the individual grows these plugs extend in breadth. A special tinctorial

¹ Ueber die Verdauung u. Resorption der Eiweisskörper im Magen und Anfangsteil des Dünndarms. Hofmeister's Beiträge zur chem. Phys. und Path., Band iii., Heft 7, 8.

² Die physiologische Bacteriologie des Darms beim Kaninchen, Nederlandsch Tydschrift van Geneeskunde, 24.

³ Berliner klin. Wochenschrift, 1903, No. 1.

method was necessary to demonstrate this. In the *Deutsch. med. Wochenschrift*, September 24, 1903, von Behring uses this same argument to prove that the only source of infection with tubercle bacilli in the human infant is milk of the human mother or tuberculous cows.

The Bacteriology of Dysentery and Summer Diarrhoea of Children. There can be no doubt at the present time that dysentery can be caused by a variety of micro-organisms. The amoebic dysentery, first classically described by Kartulis, has been confirmed as occurring in this country by many competent American investigators. After the discovery of the cause of the dysentery, which is epidemic in Japan, by the Japanese bacteriologist, Shiga, Flexner discovered that the same organism is the cause of certain types of this disease in this country. A. J. Lartigau¹ found that the bacillus pyocyaneus was the cause of fifteen cases of dysentery occurring at Hartwick. In 1901 and 1902 I found that the dysentery occurring in two children of one family was due to the "*Lamblia duodenalis*" (Lambl, 1859). Lambl has discovered two organisms which are named after him—one in 1859 and one in 1875.² This parasite is a protozoan belonging to the flagellata. In one of my cases the stools were examined by Dr. C. W. Stiles,³ of the Bureau of Animal Industry, Washington, D. C., who pronounced it the first case of the presence of this parasite in man which has yet been diagnosed in the United States.

Ward⁴ describes the case of an American physician who contracted dysentery in the Philippines. The amoeba coli and the ova of uncinaria were found in the stools, and both infections were believed to have been simultaneously present from the first. The bacterial flora of forty-two typical cases of summer diarrhoea of infants have been studied by C. W. Duval and V. H. Bassett⁵ at the Thomas Wilson Sanitarium of Baltimore. They succeeded in isolating from the stools the bacillus dysenteriae of Shiga. They believe their findings justify the conclusion that the summer diarrhoeas of infants are caused by the intestinal infection with the bacillus dysenteriae of Shiga, and, therefore, are etiologically identical with the acute bacillary dysentery of adults.

This last sentence is dangerous from its sweeping generalization. If from what I have said above the forms of dysentery in the adult are unquestionably due to a variety of forms of micro-organisms, the same can be demonstrated to be true of the group of diseases known as the infantile summer diarrhoea. In addition to the fact that the summer

¹ Journal of Experimental Medicine, vol. iii. p. 595.

² Hemmeter. Diseases of the Intestines, vol. ii. p. 544.

³ Washington Medical Annals, March, 1902, vol. i., No. 1, p. 64.

⁴ Albany Medical Annals, January, 1903.

⁵ American Medicine, September, 1902, p. 417.

diarrhoea of infants may be due to entirely different organisms, some of which belong to the group of protozoa, as, for instance, in my cases, there have been demonstrated such elementary differences in the variety of bacilli found in the intestines of those suffering from acute dysentery that the hope of a serum treatment for dysentery is still very remote.

Martini and Lentz assert that the Shiga type of dysentery bacillus differs from Flexner's Manila-Baltimore type in cultural and agglutination reaction; and Park and Carey¹ suggest that in Japan, as well as in America and elsewhere, there is not only one, but several varieties of this group of bacillus dysenteriae of Shiga. In the United States the more accurate agglutination tests and new culture media have brought to light the fact that in different epidemics the bacilli believed to have excited the disease vary so greatly from the original culture of Shiga that at present it is impossible to decide whether a single group can comprise all these varieties; and in my opinion it will be as yet impossible to predict whether the bactericidal properties obtained through the injection of animals with one type of culture can produce a serum which will cure the dysentery in persons suffering from another type. All this should caution us to be conservative with regard to the promises of a curative serum treatment for dysentery.

Gastrointestinal Autointoxication. The most comprehensive treatment of this subject in American literature has been given by myself.²

Ravenna succeeded in demonstrating experimentally that degenerative changes could be produced in the ganglia of the plexus of Meisner and Auerbach, with increase of the connective tissue, by introducing certain toxins into the intestines of guinea-pigs and rabbits. Even in the human being these changes could be demonstrated, and were more evident after acute than after chronic enteritis.³

THE ORIGIN AND DEVELOPMENT OF THE ETHEREAL SULPHATES. Sulphuric acid occurs in the urine in two forms: (1) the preformed sulphates, and (2) the ethereal sulphates. The ethereal sulphates have, since the important researches of Baumann and Herter,⁴ been looked upon as an important criterion of the degree of intestinal putrefaction. The presence of the conjugate sulphates in the urine has gained important physiological and toxicological significance by the work of Baumann, showing that the formation of phenol-sulphuric acid is an expression of an antitoxic influence of the organism in rendering the

¹ Journal of Medical Research, March, 1903, p. 189.

² International Clinics, 12th series, vol. i. pp. 107-126, and vol. ii. pp. 155-176.

³ Sulla patologia dei plessi nervosi del intestino. Arch. per le scienze méd. del Bizzozero.

⁴ Zeitschrift f. physik. Chem., Band i. p. 244.

phenol less poisonous—phenol being a substance which is formed in the intestinal canal as a result of putrefaction of proteid substances, and is excreted in the form of an ethereal sulphate, together with numerous other substances of a toxic nature which are combined with sulphuric acid in a similar way before their excretion.

As far as our efforts at intestinal asepsis are concerned, it was important to know whether the ethereal sulphates are formed in the intestine or in another organ, for if they are to serve as an index of intestinal putrefaction this question is very important. Numerous investigators have attempted a solution of it, and the most recent is by Gustav Embden and Karl Glaessner.¹ They arrive at the conclusion that the liver is by far the most important organ concerned in the formation of the ethereal sulphates. Small amounts of ethereal sulphates are also formed in the kidneys and lungs. They failed to demonstrate that the intestine produces ethereal sulphates.

The Influence of Antiseptics in the Quantity of Bacteria in the Intestines. J. Strasburger² has found by clinical observation and animal experimentation that it is useless to attempt intestinal antiseptis by the administration of drugs. A slight decrease in bacterial growth may at first occur, especially in the small intestine; but this is soon followed by an increase, owing to interference with the natural protective powers of the bowel. The bacteria in the bowel are for several reasons necessary for the well-being of the organism, and a rational antiseptis should have in view the holding of the number and kind of bacteria within normal bounds. Purgatives are the most effective antiseptics, as they remove the culture media upon which the bacteria flourish. But even here there is a danger of interfering with normal functions, as is shown by an increase in the bacteria some time after their administration. The best way to accomplish a practical intestinal antiseptis is by producing a normal condition of the intestines themselves and by administering food that is easily and rapidly digested.³

It is impossible to abstract such a long article as that by myself within the limits of this report, but our main hope for the future lies not in intestinal antiseptis, but in lavage of the stomach and colon and increasing elimination through the kidneys and skin. I do not wish to imply that the so-called intestinal antiseptics are absolutely useless, for it has been found by R. Stern,⁴ in disinfection of the intestinal canal, that the bacteria which are passed out after the use of calomel, for instance, die within twenty-four hours after the passage of the stool, and

¹ Hofmeister's Beiträge zur chem. u. physik. Pathologie, Band i. p. 310.

² Zeitschrift f. klin. Med., Band xlviii. p. 491.

³ International Clinics, twelfth series, vols. i. and ii.

⁴ Zeitschrift f. Hygiene, Band xii.

Mieczkowski found that after large doses of menthol the chyme flowing out of a fistula of the small intestine could no longer be used as a culture media for intestinal bacteria.

Effects of Resection of the Intestine. In connection with the large parts of the human intestine which are from time to time reported as having been removed surgically, the following investigation is of importance. Joseph Erlanger and Albion Walter Hewlett,¹ from "A Study of Metabolism in Dogs with Shortened Small Intestines," conclude that:

1. Dogs from which from 70 to 83 per cent. of the combined jejunum and ileum have been removed may live indefinitely after recovery from the operation. Their nutrition may appear to be perfectly normal, or it may be so poor that even when eating ravenously they do not appear to be able to keep well nourished.

2. Such dogs are peculiarly liable to be affected with diarrhœa, which may be caused by a diet too rich in fat or one containing too much inert, non-digestible material. This diarrhœa is of very serious moment to such a dog, and may cause its death.

3. The urine of such dogs shows no great variation in quantity, specific gravity, or nitrogenous contents from that of normal animals.

4. The conjugate sulphates in the urine are increased absolutely and relatively to the alkaline sulphates, indicating an excess of intestinal putrefaction.

5. The quantity of fæces varied in their two animals. In the dog from which 70 per cent. of the movable small intestine had been removed there was no marked increase in the amount of fæces; in the dog from which 82 per cent. had been removed the amount of fæces was increased.

6. The percentage of water in the fæces of dogs deprived of large amounts of small intestine may equal or only slightly exceed the percentage of water in the fæces of normal dogs. This is in contrast with the increased percentage of water in the fæces of animals deprived of the large intestine.

7. On a diet poor in fat the dog with the shortened small intestine absorbs the fat as well or almost as well as a normal dog. As the fat in the diet is increased the fall in the percentage eliminated in the fæces which occurs in the normal animal may either occur to a less extent or may not occur at all in dogs deprived of small intestine. With large amounts of fat in the diet 25 per cent. of that ingested may appear in the fæces, whereas in their normal dog only about 4.5 per cent. appeared.

¹ American Journal of Physiology, September 1, 1901, vol. vi. p. 26.

8. The addition of fat to the diet of a normal dog does not greatly affect the amount of nitrogenous material eliminated by the faeces. The addition of fat to the diet of dogs deprived of small intestine causes an increased elimination of nitrogenous material in the faeces. On a diet rich in fat the amount of nitrogen eliminated in the faeces may be double that eliminated by a normal dog, although on a diet poor in fat there is no great difference between the two.

These experiments of Erlanger and Hewlett confirm my observations on human beings who had been subjected to the necessity of the excision of a large part of their intestine, and as a consequence of defective utilization of the food they are very much more prone to infectious diseases than people with the normal length of intestine. A person deprived of from five to six feet of his intestine is, in my opinion, as much maimed and more hopeless in the struggle for existence than a cripple after a hip-joint amputation.

Meteorism and Intestinal Atony. Van Noorden recommends physostigmine in doses of 0.0005 to 0.0007, three to four times daily, in the form of a powder with milk-sugar. The undesirable collateral effects he combats with small doses of atropine.

Sigmoiditis. Following the recognition of this localized inflammation of the sigmoid flexure which was given by Mayor, and two cases observed by myself,¹ Bittorf² describes two cases of inflammation of the sigmoid flexure due to *coprostasis*, and Messedaglia³ gives a literary compilation of all cases of this kind thus far reported. In one of Messedaglia's cases the inflammation had started from a rectal fistula. All of these cases may lead to perisigmoid abscesses and perforation. The treatment must be directed to keeping the sigmoid flexure clean by liquid diet and castor oil, irrigations with solutions of tannic acid, and absolute rest in bed. The principal symptoms are a cylindrical resistance sensitive to pressure in the left iliac region, meteorism, fever, alteration of the general condition, and sometimes sigmoid volvulus. The diagnosis must exclude tumors, paranephritic abscesses, perityphlitis, and pericolitis.

Neoplasms and Tumors. W. R. Stokes⁴ and myself have described a case of chronic hypertrophic gastritis of syphilitic origin. Two similar cases have since been reported, one by Müller⁵ and the other by Heinrich Gross.⁶ These cases are important not only as neoplasms, but also as causes of gastric and intestinal strictures.

¹ Hemmeter. *Diseases of the Intestines*, vol. i. p. 505.

² *Berliner klin. Wochenschrift*, 1903, No. 7.

³ *Il Morgagni*, part i., H. 6, p. 375.

⁴ *Archiv f. Verdauungs*, Band vii. S. 4, 5.

⁵ *Wiener klin. Rundschau*, 1902, No. 12.

⁶ *Münchener med. Wochenschrift*, 1903, No. 1.

Intestinal Occlusion due to Cholelithiasis. The diagnosis of intestinal obstruction is a serious matter to the general practitioner in those cases in which the intestinal obstruction is a result of a precursory condition which generally falls under the observation of the practitioner. During the past year (1902 to 1903) I have had five cases of duodenal and jejunal obstruction which were the direct result of cholelithiasis. In four of these cases the diagnosis of cholelithiasis was established before the operation. All four had dilated stomachs, with a fairly normal or excessive secretion of HCl. In two the enlarged gall-bladder and pericystic inflammation were palpable. The operations were performed in one case by John B. Deaver; two by L. McLane Tiffany; one by J. M. T. Finney, and one by Randolph Winslow. In all of these cases the normal function of the intestine was restored and recovery perfect. In one case—that operated on by Finney—the gallstones had perforated the gall-bladder, and twelve of them were found lying in a space surrounded by peritonitic adhesions, some of which extended around the duodenum about an inch below the pylorus. In another case—that operated on by Winslow—the entire gall-bladder had become cirrhotic, and had tightly contracted around a gallstone the size of a small marble. There were also adhesions extending to the duodenum, and stones in the common duct. The case operated on by Deaver I did not see at the operation, and do not know the particulars. In addition to these five cases I have a record of five others which were operated on in previous years in which adhesions primarily due to cholecystitis and cholelithiasis caused duodenal and jejunal strangulation by adhesions. J. Bodganik¹ reports two cases of intestinal occlusion associated with cholelithiasis in which the symptoms of this latter disease were not evident, but alarming symptoms of acute occlusion called for immediate laparotomy. All such cases demonstrate the wisdom of early operation in all cases of intestinal occlusion, whether the cause is known or not, and, furthermore, that all cases of gallstone disease should be advised to consent to operation as a matter of principle, just as we advise operation for purulent appendicitis. In only two out of the five cases of occlusion due to cholelithiasis was there a distinct history of previous jaundice, which confirms the assertion of Hans Kehr that jaundice is a rather rare occurrence in connection with this disease.

In the section devoted to the diseases of the liver I shall return to a consideration of this subject.

Colica Mucosa; Mucous Colic of the Intestine. Van Noorden and Dapper assert that the condition is chiefly a neurosis of secretion, and

¹ Wiener med. Presse, No. 45.

this justifies them in rejecting the safe bland diet and advising a stimulating and brusque diet, with considerable dietetic ballast, in order to combat the constipation which they conceive to be the main cause of colica mucosa. They also recommend oil clysters, massage, and mineral waters. In criticism of this monograph of Van Noorden I have to call attention to the fact that while there is a colica mucosa which is not associated with any anatomical changes in the colon, there is undoubtedly also a *colitis membranacea* which is associated with anatomical changes and clinically very difficult to distinguish from the purely neurotic form which these authors describe, and the treatment advised by them would, if applied to the colitis membranacea, actually do harm in my opinion. Personally I would recommend trying the bland diet first. For instance, a diet consisting of rice, sago, farina, strained oatmeal, chocolate, white bread, egg albumen and gelatin, and a small amount of good wine, gradually passing over to a diet of scraped meat, bread and butter. Milk should be excluded until improvement is very evident.

Enteroptosis; Gastropoptosis. The various hypotheses concerning this condition, the methods of diagnosis and treatment, have recently been ably recapitulated in American literature by J. Dutton Steele¹ and Albert P. Francine.² The deductions of both of these writers are based on considerable experience, and while they present nothing new it is a comfort to realize that we are more and more approaching clearly established principles in diagnosis and treatment. J. Dutton Steele emphasizes that the treatment must chiefly be directed to securing rest for the stomach. This is best accomplished by allowing only small amounts of food at a time, and by making sure that the stomach has a period of rest between the meals in which it is absolutely free of food. This can only be ascertained, of course, by repeated examinations with the stomach-tube. If the stomach is not entirely empty after five hours after a meal we must allow six hours, and so on. The operation for restoring a displaced stomach, as first suggested by Beyea and employed in a case of Stengel's, has been described in the preceding text. The operation consists in shortening the gastrohepatic omentum by a series of ligatures. Since the publication of the article by Stengel and Beyea,³ Blecher⁴ has reported four cases of gastropoptosis and one of enteroptosis which were treated by a similar operation by Bier, with very satisfac-

¹ Gastropoptosis and Gastric Motor Insufficiency. Philadelphia Medical Journal, January 25, 1902.

² Gastropoptosis: A Critical and Clinical Study, with Reference to 100 Cases, Philadelphia Medical Journal, January 3, 1903.

³ Transactions of the College of Physicians, vol. xxi.

⁴ Deutsche Archiv f. Chirurgie, 1900.

tory results. Webster has recently recommended an operation which seeks to restore the tonicity of the abdominal recti muscles by excising that portion of the connective tissue lying between the recti and thereafter stitching the muscles together. A strip of skin and fat is cut away from the side of the wound before it is closed. It is noteworthy to emphasize that both Blecher and Webster insist on prolonged after-treatment of rest and massage and abdominal support, and Blecher urges that an operation is only desirable when a prolonged rest cure and the use of an abdominal support have proved to be of no benefit, when the ptosis is extreme, or when the patient is unable to afford the time and money for more conservative treatment.

In a very extensive personal experience I have found the diet and rest cure with abdominal support sufficient in the great majority of cases of gastropptosis; massage and electricity and hydrotherapeutics, together with tonic medication, are generally indispensable. I do not mean to assert that permanent restoration of the stomach to its normal position may occur by non-operative measures, but I do believe that the comfort of the patient and comparative normal function of the stomach and intestines can be immeasurably increased by non-operative treatment.

This is not the proper place to speak of the many devices for supporting the abdomen, but it will do no harm to again emphasize the necessity for restoring the support to the pelvic floor in women suffering from enteroptosis. Abdominal support and restoring the recti will do little good when the uterus and adnexa can be displaced into the lower pelvis by the external abdominal pressure. The after-treatment of pregnancy must also be here referred to, nor will it be considered redundant to refer once more to the excellent work of Stiller in placing the pathogenesis of enteroptosis in a new light and showing its relations to a *universal congenital asthenia*, the pathognomonic stigma of which is the floating or movable tenth rib. Stiller's work is, in fact, epoch-making, and tends to bring all those disturbances of digestive function which we call "atony" under the diagnostic restrictions of ptosis and the dilatations which may result therefrom. The more I study Stiller's publications and his doctrines on enteroptosis, the more I am impressed with the force of his logic and the correctness of his conclusions. The floating tenth rib, in my experience, occurs in four-fifths of all cases of enteroptosis and gastropptosis. Of course, it is very important to know whether the tenth rib cannot be normally floating, and what the real anatomical connections of the tenth rib are with the costal arch. This subject has been very carefully studied by Stiller on the reports of well-known anatomists, and there is no doubt that the tenth rib in healthy individuals is strongly and immovably fixed to the

costal arch. Stiller¹ has recently replied to his critics, particularly Zweig, with irresistible logic.

Appendicitis. There is no medical literature in the world which has handled this subject with greater precision and clearness than American medical literature. The pathogenesis, diagnosis, and treatment of appendicitis have been thoroughly considered in previous numbers of *PROGRESSIVE MEDICINE*. Perhaps one of the most exhaustive articles in American literature, published in 1902, is that by myself.² Incidentally I might call attention to the article on "Intestinal Occlusion" in the same work, which brings up the entire literature of the subject to 1902, and in 322 pages represents the most complete recent contribution to that subject of American origin.

The recent literature of genuine interest is not very abundant. A very curious relation between abscess of the tonsil and appendicitis has been reported by Hans Weber.³ There were three cases of angina tonsillaris immediately followed by acute appendicitis, and Weber conceives that the infected material was swallowed, and, reaching the appendix, there set up an inflammation. Similar cases have been reported previously. Such instances demonstrate that the cause of appendicitis must not always be sought in purely local changes, but that remote infections and also general infections of the organism may involve the appendix. Thus, we find appendicitis in measles, influenza, parotitis, pyæmia, and even in infections by pneumococci. Sevestre and also Achard and Bracca have reported cases of appendicitis in which the pus contained pneumococci, and in a recent publication Ferrier⁴ describes the case of a man, aged twenty-two years, who began with a right-sided pneumonia, later on diarrhœa, and pains under the right costal border. The patient died. The autopsy revealed the appendix enlarged to the thickness of the thumb, freely movable, surface smooth, containing in its interior two or three coffee-spoonfuls of creamy pus. On the mitral valve there was a fresh endocarditis; from the pus of the appendix pneumococci and the colon bacillus were cultivated.

Intestinal Indigestion; Dystrypsia. This complex pathological condition has recently been worked over by myself.⁵ In the same number of the *Medical News* E. Franklin Smith⁶ has reviewed some of the etiological factors in intestinal dystrypsia, in which he adopts my

¹ Archiv f. Verdauungs-krankheiten, Band vii. p. 275.

² Hemmeter. Diseases of the Intestines, vol. ii. pp. 1 to 86, with illustrations.

³ Münchener med. Wochenschrift, 1902, No. 52.

⁴ Bulletin et mém. de la soc. méd. des hôp., No. 28.

⁵ Hemmeter. Intestinal Indigestion (Dystrypsia). Address before the New York Academy of Medicine, December 16, 1902. Medical News, April 18, 1903.

⁶ Loc. cit., p. 727.

classification. That abnormal processes of digestion can occur within the intestine without any coexistent pathological changes is the chief argument of these papers, but it must be emphasized that they may lead to anatomical changes if the dystrypsia continues.

By intestinal dystrypsia¹ I prefer that the word dystrypsia should be limited to those abnormal forms of intestinal indigestion not associated with actual enteritis or any organic changes, but in which there is chiefly an abnormal fermentation of the carbohydrates, an insufficient digestion of the starches. That these changes are frequent in persons of a neurotic nature has been pointed out by Schmidt and Strasberger.² The main object of the treatment is to restrict or exclude these starchy foods, favor evacuation and cleansing of the intestine, for which I prefer two methods, either singly or both together, namely, the time-honored calomel by the mouth or high colon irrigations. The latter can, of course, not influence the abnormal processes in the small intestine, but only prevent the ensuing changes in the colon.

Intestinal Parasites. This subject has already been to some extent dwelt upon in the paragraph devoted to dysentery.

EOSINOPHILIA AND INTESTINAL WORMS. Launois and Weil³ describe a case of *epidermic cysticercus* in which the eosinophilia was reduced after removal of the parasite. A similar reduction of the number of eosinophiles was effected by the injection of extract of male fern. They assert, however, that eosinophilia is an inconstant sign in the presence of *hydatid cysts*. The presence of eosinophilia supports the diagnosis, but its absence does not contraindicate it. The experimental production of eosinophilia by the injection of the contents of a hydatid cyst, or the inoculation with ground-up tapeworms, did not succeed; but Achard and Loeper brought on eosinophilia by injecting the liquid of an echinococcus cyst into a mouse. Evidently a number of widely different factors are necessary to produce eosinophilia under such conditions, prominent of which are the special idiosyncrasy of the host and the virulence of the parasites employed for the purpose.

Achard mentions that he has successfully treated hydatid cysts of the liver by injections of extract of male fern. In one case of hepatic cyst no tumor was palpable after three months.

¹ I have first suggested the name of *intestinal dystrypsia* for this condition, because intestinal "dyspepsia" cannot be considered the proper designation, inasmuch as pepsin is physiologically not active in the intestine. The original orthologic derivation of the word "pepsin," coming from the Greek word *πεπτεω*, to digest, also to cook, cannot weaken my claim of the urgency of the new term "dystrypsia," for at present we do not associate the word "pepsin" with its old Greek meaning, but we understand by this word a definite and well-known ferment formed in the stomach.

² Die Fæces des Menschen, S. 186.

³ Bulletin et mém. de la soc. méd. hôp., No. 32.

BALANTIDIUM COLI AS A CAUSE OF INTESTINAL INFECTION. W. Klimenko¹ reports severe intestinal infections with this organism, the symptoms resembling dysentery. The balantidium² is taken into the intestinal canal in pork. Anatomically it causes a condition resembling ulcerative colitis. The mortality of these infections is given as 17 per cent.

PREVALENCE AND GEOGRAPHICAL DISTRIBUTION OF HOOKWORM DISEASE (UNCINARIASIS OR ANKYLOSTOMIASIS). Charles Wardell Stiles,³ in a scholarly monograph of 121 pages, treats exhaustively of intestinal infection with the hookworm, the morphology, mode of infection with uncinaria, the diagnosis, and treatment. It is of importance to know that uncinariasis is of frequent occurrence in the United States. Stiles has pointed out that we have in this country a form of the disease which is due to a special variety of the parasite, the uncinaria Americana.⁴ Concerning the methods of diagnosis no special technique is necessary. A small amount of feces are taken from near the surface of the mass, about the size of the head of a large pin. This is spread out in a drop of water on a large two by three-inch slide, which is more easily manipulated by the ordinary size of slide, and is much cleaner to handle. The examination is made with a Zeiss 8 mm., Zeiss C, or a Bausch & Lomb one-third inch. It is not well to use too strong an illumination, and we should look carefully for an elongate oval egg with thin shell and with protoplasm either unsegmented or in the early stages of segmentation. The older the feces and the warmer the weather, the more advanced will be the segmentation. In case of infection with uncinaria Americana the fully developed embryo may be found within the egg-shell. We must be careful not to mistake for the eggs of the uncinaria the eggs of *ascaris lumbricoides*, which have a thick, gelatinous, often mammillated covering and an unsegmented protoplasm, or the eggs of *oxyuris vermicularis*, with a thin, asymmetrical shell (one side being almost straight) and containing an embryo, or the eggs of whipworms (*trichuris trichura*, more commonly known as *trichocephalus dispar*), possessing a smooth, thick shell, apparently perforated at each pole, and an unsegmented protoplasm.

METHOD OF WASHING AND SEDIMENTING FÆCES. Take one or two ounces of feces, fresh or dry, mix with water, and place in a large bottle, retort, jar, or any other receptacle; add enough water to form

¹ Ziegler's Beiträge zur path. Anat. u. Allg. Path., Band xxxiii. S. 281.

² For illustrations of balantidium coli and further particulars, see Hemmeter's Diseases of the Intestines, vol. ii. p. 545.

³ Report of Public Health and Marine Hospital Service of the United States, Bulletin No. 10, published February, 1903.

⁴ First reported to the annual session of the American Gastro-enteriologic Association, Washington, May, 1902.

a pint to two quarts, according to the amount of fæces; shake or stir thoroughly and allow to settle; pour off the floating matter and the water down to near the sediment; repeat the washing and settling several times, or as long as any matter will float. The last time this is done use a bottle or graduate with a smaller diameter, and when the material is thoroughly settled examine the fine sediment. It will be found that the eggs have settled more numerous in the fine sediment than in the coarse material.

In case an unusual amount of large, coarse material is present in the fæces, it is sometimes convenient to pour the entire mass through a sieve, rejecting the portion left in the sieve; or, to wash the fæces in a sieve, holding the latter under water. As a rule, however, the sieve is not very useful in fecal examinations.

The centrifuge does not appear to be of any special value in fecal examinations.

THE BLOTTING-PAPER TEST WITH FÆCES. For persons who are not in a position to make a microscopic examination the blotting-paper test will be found very useful. To make the test use only fresh fæces. Place an ounce or more of the stool on a piece of white blotting-paper (any absorbent white paper will answer the purpose); allow to stand for twenty to sixty minutes; remove the fæces, and examine the color of the stain. In about four out of five cases of medium or severe uncinariasis the stain is reddish-brown and immediately reminds one of a blood stain. In making this test on anæmic patients hemorrhoids should, of course, be excluded.

THE TREATMENT OF UNCINARIASIS is by thymol and extract of male fern. Calomel is occasionally advocated.

LOOSS' THEORY OF CUTANEOUS INFECTION WITH UNCINARIASIS. Looss¹ in these publications advanced the startling opinion that the embryos of *ankylostoma doudenale* when placed upon the skin in a drop of water enter the hair-follicles, and from there they seem to bore into the surrounding tissues. Further on they reach the intestines, and there develop into the full parasite. F. M. Sandwith confirmed these observations of Looss, detailing an experiment in which a mixture of charcoal and fæces in which the hookworm larvæ had been bred was smeared on the back of a puppy. Between nine and ten days after the puppy died, and was found to have anæmia in most of his organs, and a plentiful supply of young uncinaria were found in his

¹ Ueber das Eindringen der Ankylostomalarven in die menschliche Haut (Centralblatt f. Bakteriöl., Parasitenk., etc., Jena, 1 Abt., v. 29 (18), 31 Mai, 1901, pp. 733-739, 1 pl., Figs. 1-3), and Weiteres über die Einwanderung der Ankylostomen von der Haut aus (Centralblatt f. Bakteriöl., Parasitenk., etc., Jena, 1 Abt., v. 33 (5), 6 Feb., 1903. Originale, pp. 330-343 (MS. dated December, 1902).

jejunum. A second puppy was treated in a similar way, and also died between the ninth and tenth day, the post-mortem showing the same results. The objection to these experiments is that the puppies may have licked up the fecal smear from their back, and that the uncinaria entered the gastric intestinal canal through swallowing. This objection is, however, satisfied by the experiment upon a man, who offered himself to be treated in a similar way upon his forearm, and in his case the first hookworm egg was discovered in his fæces on the seventy-first day. In all three experiments the fæces were regularly examined for some weeks prior to the experiments, so that the results must be accepted, although they are very startling.¹ A large amount of further experimental material, especially narrating the experiments of Bentley, that the so-called "ground-itch," a form of water sore or affection of the skin confined to the lower extremities, is probably always associated with the larvæ of uncinaria, will be found in the report by C. W. Stiles, above cited. The prophylaxis, therefore, of uncinariasis should take in the disinfection of all skin lesions by carbolic acid or bichloride of mercury, and subsequent protective covering.

STRONGYLOIDES INTESTINALIS IN THE UNITED STATES. After a history of this intestinal infection as it occurs in other countries, Price² gives the life-history of the parasite and reports a case coming under his own observation. In the discussion on this paper three other physicians reported having observed intestinal affections with this parasite. This shows it to be a more common infection in the United States than was hitherto believed.

CLINICAL DIAGNOSIS OF INTESTINAL PARASITES. At the same meeting C. W. Stiles insisted that in all persistent cases of intestinal disease the stools should be regularly examined as long as there was any doubt in the diagnosis. His methods for examining the stools for parasites and their ova have already been stated in the preceding text, and consist mainly in agitating part of the fæces with water in a glass jar, then allowing to stand for a short time, and finally the upper liquid poured off. All intestinal parasites sink in water, and can be easily found in the sediment after repeated washing.

Dietetics and Therapy. **METABOLISM ON ORDINARY AND FORCED DIETS IN NORMAL INDIVIDUALS.** In a study of this subject Francis W. Goodbody, Noel D. Bardswell, and J. E. Chapman³ present the following conclusions :

¹ F. M. Sandwith. Proof that *Ankylostoma* Larvæ Can Enter the Skin. *Journal of Tropical Medicine*, London, December 15, 1902, p. 380.

² Paper read for the Section on Practice of Medicine, American Medical Association, New Orleans, La., May 5, 1903.

³ *Journal of Physiology*, July 21, 1902, vol. xxviii., No. 4, p. 257.

1. The lasting bad effects of an excessive diet on normal individuals.
2. The very small quantity of nitrogen retained except when extreme forced feeding is employed.
3. The increased quantity of urine passed and very high specific gravity, more or less proportional to the intake of fluids, this being contrary to what has been observed in pathological conditions.
4. The marked increase in the quantity of total nitrogen in the urine of forced feeding, the proportion of this substance passed as urea remaining normal all through, and there being no marked difference in the proportion of uric acid and ammonia, although there was a slight tendency to increase in the quantity of nitrogen, rest on forced feeding.
5. The marked increase in the inorganic constituents of the urine analyzed for during the period of forced feeding.
6. The fact that, contrary to what was to be expected, there was no marked increase in the total quantity of nitrogen in the fæces on the forced feeding except in Case III., while, as a rule, there was an enormous increase in the total of fats.
7. The temporary increase in the rate of absorption of nitrogen on forced feeding as against the tendency to diminution in the rate of absorption of fats during the same period.
8. The very rapid increase in weight during the period of forced feeding and the very striking rapidity with which this increase disappeared.
9. The marked deterioration in health caused by forced feeding.

Gastric and Intestinal Crises. This was the title of an address to the German Medical Society of New York by Prof. C. A. Ewald, of Berlin. Ewald discussed these phenomena as they arose, and were traceable to a lesion of functional disturbance of the kidneys, liver, uterine and ovarian troubles, parasites, autointoxication.

Only in a small degree did he believe them to be the expression of disease of the stomach and intestine. He described the early manifestation of *tabes dorsalis*; the crises return at shorter and shorter intervals, and they last from one-half to forty-eight hours. He admitted that we were ignorant as to the nature of the crises, but favored the view that they were due to an autointoxication by a toxin which could only influence abnormal nerves, the attacks increasing in severity as the degeneration progresses. In grave cases morphine must be given. Ewald has no faith in the efficacy of cerium oxalate, but believes that great comfort can be obtained by epidural injections of cocaine.

DISEASES OF THE LIVER.

Icterus. Concerning the etiology of icterus, in association with *hypertrophic cirrhosis*, Gérardel reports the microscopic examination of

two cases of hypertrophic cirrhosis from which he seeks to demonstrate that the name of *biliary cirrhosis* (Charcot and Hanot) is a misnomer.¹ As is well known, we may make a distinction clinically and pathologically between two essentially different forms of hepatic cirrhosis. 1. One is called the *Laennec cirrhosis*, which is a granular chronic interstitial hepatitis, in the great majority of cases due to alcoholism. This form must carefully be distinguished from the syphilitic, malarial biliary cirrhosis and that due to passive venous congestion. 2. The second form of liver cirrhosis has frequently been called the biliary form, of which there are two sub-varieties: (a) the cirrhosis due to the stagnation of bile caused by gallstones, and (b) the so-called hypertrophic biliary cirrhosis (cirrhose hypertrophique avec ictère chronique), a designation original with Charcot and Hanot. It is this form of cirrhosis with considerable enlargement of the liver, chronic and intense icterus, an enlarged spleen, without ascites, the pathogenesis of which is still obscure. It has nothing to do with alcoholic abuse, and constitutes a disease peculiar to itself. Charcot and Hanot selected the name "biliary cirrhosis," on the assumption that it was due to inflammatory lesions of the bile capillaries, and it is this assumption which Gérardel contests, for he found in his two cases that the bile capillaries were perfectly intact, their cells easily stainable and well defined. The liver parenchyma was studded with numerous nodular accumulations of cells, which contained masses of mononuclear cells within a connective-tissue meshwork. These nodules also contained veins and capillaries. Although the icterus had existed for years in his patients, there was no trace of pericholangitis.

This research suggests that icterus is not due to disease of the excretory elements, but to some abnormality in the secretory function or metabolism in the liver cells.

UROLOGY OF ICTERUS. Referring to the preceding section of hepatic insufficiency and the difficulty in forming an estimate of this condition from the urinary signs, the researches of S. Simnitzki and P. Rodoslawow² are of importance as proving that in catarrhal icterus as well as in hypertrophic cirrhosis of the liver a sufficient quantity of urea and phosphates is secreted, and that this quantity may at times exceed the normal. The relative quantity of phosphoric acid secreted is very close to the normal; the amount of the chlorides of the urine is more frequently reduced. The excretion of the extractive substances is increased, and the quantity of uric acid is only slightly increased. The relative amount of the ethereal sulphates shows no or very slight

¹ Comptes rendus de la société de biologie, No. 37.

² Centralblatt f. Stoffwechsel und Verdauungs-krankheiten, Erstes März-Heft, 1903, No. 5.

changes. The oxidation processes are lower than under normal conditions.

CHRONIC CONGENITAL ICTERUS. Widal and Ravaut¹ presented a patient, aged twenty-nine years, who had been jaundiced since birth, and with the exception of transient constipation had never felt sick. The authors attributed the congenital form of icterus to a hereditary infirmity, a kind of degenerescence of the liver cell which leads to increased formation of bile (*diabète biliaire*). The father of this patient had an enlarged liver due to alcoholism. Vaques found an enlargement of the blood cells in this patient, which he attributes to the penetration of foreign substances into the body of the corpuscles. He could demonstrate an imbibition of the bile pigment into these corpuscles.

Hypertrophic Cirrhosis of the Liver and Leukæmia. Bigart² found a disturbance of the hæmatopoietic functions, an increase of the myelocytes from the normal, which is 0.5 per cent., to 20.6 per cent. in Hanot's liver cirrhosis. This he does not conceive to be one of the ordinary forms of infectious leucocytosis, but a peculiar variety of leukæmia. Further on he draws analogy between hypertrophic liver cirrhosis and leukæmia.

Among the most helpful clinical researches for the general practitioner are those which throw light upon the precursory stages of gastric disease that lead up to catarrhal jaundice, icterus, and cholelithiasis. Naturally this relation emphasizes the far-reaching value of prophylactic treatment. As cholelithiasis is recognized among the most frequent causes of cancer of the gall-bladder, it is conceivable how the cure of a chronic gastritis may prevent development of malignant disease of the gall-bladder. It is for this reason that the following researches of Simnitzki are cited with some detail.

GASTRIC DIGESTION IN ICTERUS. S. S. Simnitzki³ concludes: 1. That in jaundice, as in all cases of retention of bile in the organism, the gastric function is affected, a hypersecretion being established. This overwork brings about a peculiar condition of the secretory gastric cell—its asthenia. 2. The gastric secretory activity is alike both in acute and in chronic jaundice—*e. g.*, when the latter appears in connection with hypertrophic cirrhosis of the liver—provided that no changes in the activity of the secretory gastric cells had occurred previous to the appearance of the jaundice. 3. In chronic jaundice—*e. g.*, when it appears in connection with hypertrophic cirrhosis of the liver—there are stages of transition in the activity of the secretory

¹ Soc. méd. des hôp., November 21, 1902.

² Comptes rendus de la société de biologie, No. 37.

³ Russki Wratsch, 1903, Nos. 1 and 2.

gastric cell from hypersecretion to hyposecretion, the latter sometimes very pronounced. These phenomena are the results of the same condition of the secretory gastric cell, its asthenia appearing only in different degrees and periods. 4. The diminution of the acid secretion of the secretory gastric cells during certain stages of hypertrophic cirrhosis of the liver with jaundice, while the peptic secretion remains the same, would tend to prove that the peptic secretory activity of the stomach is of a stronger and more resisting character than its acid secretory activity.

Whenever jaundice is not complicated with distinct gastric catarrh a condition of high hyperacidity was noted in the stomach contents after a test breakfast. The hyperacidity was demonstrably due to hypersecretion, and experiments on dogs confirmed these clinical observations. In harmony with Pawlow's scholarly and important researches Simnitzki attempts to explain these alterations by postulating a diseased or asthenic state of the gastric secretory cell, due to poisoning with biliary products. Incidentally some interesting facts were noted. The well-known preference shown by icteric patients, human and animal, for carbohydrates and their aversion to meats or fats could be accounted for by the influence of the latter upon digestion. It was found, namely, that albuminous food retarded the passage of gastric contents into the intestine and produced certain irritative phenomena, like vomiting, diarrhoea, etc., while carbohydrates did not alter the secretions and the motor activity. The diet usually prescribed in icterus (milk and carbohydrates) was very well tolerated, thus showing a complete harmony of empirical and experimental data. These results, obtained from a study of acute jaundice, apply with equal force to chronic icteric conditions as seen in hypertrophic hepatic cirrhosis, etc. A gradual transition from gastric hypersecretion to hyposecretion has been noted in protracted jaundice, and is due to the same cellular asthenia in its carrying grades and stages. When gastric acidity is thus seen to fall the peptic power of the stomach remains unabated, justifying the conclusion that the pepsin-producing activity has a greater stability than the secretion of hydrochloric acid.

These results of Simnitzki are in agreement with my own,¹ published in 1898, in which I found, in sixteen cases of catarrhal jaundice, the following state of the gastric secretion.² In twenty-two cases of icterus free and combined HCl were absent in twelve, free HCl absent but combined present in four, free and combined HCl present in six. I

¹ Dietetic and Medicinal Treatment of Icterus and Cholangitis. Bulletin of University of Maryland Hospital, 1898, p. 31.

² Hemmeter. Diseases of the Stomach, 3d edition, p. 391. (By the time the third edition was published the studies had extended to twenty-two cases.)

have repeatedly emphasized that it would be important to know whether those cases in which the free HCl was absent during the icterus had chronic gastritis before the jaundice. I was able to trace up the later history of six of eight cases whose gastric secretion contained no free HCl during the jaundice. Two months after recovery from the attack they had a normal gastric secretion, and there were no evidences of gastritis.

The important clinical deduction to be made from these researches is mainly one of prophylaxis, it being established that chronic gastritis can cause catarrhal duodenitis, and this in turn may stenose the common gall-duct and also the pancreatic duct. We must look upon the catarrhal state of the stomach as the source of all this evil, and in my opinion many operations for gallstones will be prevented by a timely cure of the chronic gastritis which may precede it by years.

Clinical Value of the Urinary Signs of Hepatic Insufficiency. L. Ingelrans and M. Dehon¹ report the results of an investigation into the value of certain urinary signs considered to be indicators of hepatic insufficiency. They investigated the so-called alimentary glycosuria, the total nitrogen of the urine—hypoazoturia, hyperammonuria, urobilinuria, and indicanuria. Sixteen persons having various hepatic lesions and three healthy persons formed the basis of the investigation. The principal conclusions reached are: 1. Alimentary glycosuria is frequently absent in diseases of the liver, even when the parenchyma of the organ is markedly altered. Its absence, then, simply proves that the glycogenic function of the liver is still retained. 2. Hypoazoturia is nearly constant when the liver is anatomically altered. 3. While it is possible that hypoazoturia and fluctuations in the azoturic ratio may not be sufficient grounds on which to affirm hepatic insufficiency, these two signs are of great value in calling the attention of the clinician to the state of the liver. 4. Indicanuria is a sign of secondary importance. 5. Urobilinuria appears to be a sign of cholæmia and not of hepatic insufficiency. 6. The signs of hepatic insufficiency are not constantly united in any one patient. The functions of the liver are readily disassociated, and one may be at fault while the others remain in good condition.

Concerning the Antitoxic Action of the Liver. P. Teissier,² in studying the effects of the liver glycogen in watery solution on various poisons, found that it very much diminished the toxicity of nicotine, had no influence on strychnine, and actually increased the toxic influence of diphtheria poison.

¹ *Archiv. de méd. expér. et d'anat. path.*, March, 1903.

² *Recherches sur l'action antitoxique in vitro du glycogène hépatique.* Soc. de biol. séance du 29 déc., 1900. *La semaine méd.*, 21e année, No. 1.

When such results are submitted to critical judgment we find that exact conclusions concerning hepatic insufficiency are difficult to form.

The Liver of the Dyspeptic; Dyspeptic Cirrhosis. Contrary to the opinion of Emile Boix,¹ in which he asserted that cirrhosis could be produced by autointoxication of gastrointestinal origin, E. Nalin² denies that dyspepsia can produce the anatomical changes underlying the clinical picture of hepatic cirrhosis. According to Nalin, a morbid infirmity or predisposition of the lymphatic organs of the liver is necessary for the development of cirrhosis. He does not deny, however, that dyspepsia may cause inflammatory changes in the liver of a mild nature.

Experimental Amyloid Degeneration of the Liver. Stefanowitsch³ has produced amyloid degeneration of the internal organs in rabbits and chickens by injecting a three days' bouillon culture of staphylococcus aureus twice weekly. A number of the animals were killed at the end of one month, and particles of the amyloid liver, spleen, and kidneys sewed into the subcutaneous areolar tissue. It was found that the amyloid substance was surrounded by a granulation tissue and converted into hyaline granules which eventually gave no amyloid reaction. Stefanowitsch assumes, therefore, that amyloid degeneration may undergo a spontaneous healing in the human being if the causes that have led up to it are removed.

Latent Fatty Degeneration of the Liver is more frequent than generally supposed, and much more common, without doubt, than all varieties of cirrhosis which develop as a result of the effect of alcohol upon the liver. This condition deserves an important place in pathology because it occurs quite frequently in young people as a concealed infirmity which inevitably aggravates the prognosis of otherwise benign diseases with which they may become infected. General practitioners have no doubt been frequently puzzled at the terrible struggle for life which young obese patients have to undergo in typhoid fever and pneumonia. The heart and the vessels are generally sound, and yet the gravity of what seems otherwise a very curable infection is inexplicable unless we assume the existence of a latent fatty degeneration of the liver. The prognosis of such infectious diseases, as well as of traumatic injuries and surgical intervention in young obese patients, must be very reserved. Of course the conception of latent fatty degeneration explains the variable course of any intercurrent diseases. As regards the recognition of such a condition, it is, of course, very difficult, and can only

¹ The Liver of Dyspeptics. Paris, 1897.

² Osservazioni ed esperienze sulla cirrosi del dispeptici. Klin. Beobachtungen über die Cirrhose der Dyspeptiker. Il Morgagni, Anno 44, parte i. H. 2.

³ Russki Wratski, 1903, No. 6.

be arrived at by exclusion. Gilbert and Lereboullet¹ call attention to this condition and promise a more detailed description of it in a future communication. As a rule, the condition is found in young obese patients who are not in an age which alcoholic cirrhosis usually develops. In fact, they seem perfectly sound and apparently not suffering under their alcoholism until an intercurrent disease attacks them, which produces such gravity that it is out of all proportion to the degree of the infection.

Healed Cirrhosis of the Liver; Histological Examination of the Liver After Death by Erysipelas. At the autopsy of a man who had suffered from ascites, cedema of the ankles, and icterus (the abdomen had been punctured twice) Apert² found a thickening of the capsule of the liver, a cirrhosis, presenting microscopically considerable vascularization of the perilobular connective-tissue bands. There was an angiomatous dilatation of the capillaries in many lobules. *The circulation between the vena cava and the portal vein had been completely restored.* Galliard³ reports the cure of an advanced cirrhosis of the liver in a female patient after all other treatment had failed. The cure was effected by giving 150 gm. of pig's liver daily.

Is the Gall-bladder a Useless and Dangerous Organ? This is the title of a paper by Dr. Woods Hutchinson.⁴ This article, together with one by Dr. Roswell Park, which appeared in *American Medicine* a few months previously (entitled "Why Not Treat the Gall-bladder as we do the Appendix?"), forced upon us the consideration of the question whether the gall-bladder is really a useless and dangerous organ. Hutchinson thinks he is "comparatively safe in saying that the principal secretions of the gall-bladder are mucus and gallstones." This statement is made in apparent disregard of the fact that the epithelial cells of the gall-bladder secrete cholesterin, the normal quantity of which can under pathological conditions be trebled (from 0.12 gm. to 0.334 gm. in the dog—C. A. Herter), and that calcium salts are secreted from the epithelial cells of the gall-bladder, and that the same irritants which increase the cholesterin can also increase the calcium salts, which is significant, for if the calcium is increased beyond a certain point it is liable to combine with bilirubin and produce a compound known as bilirubin-calcium, which forms the nucleus of a great many stones. It must, however, be emphasized that the normal gall-bladder cannot form stones. It is only the diseased gall-bladder which can produce them, or at least aid in their formation, and one of

¹ La stéatose hépatique latente alcoolique. *Gaz. hebd. de méd. et de chir.*, 1902, S. 50.

² *Soc. méd. des hôp.*, January 16, 1903.

³ *Ibid.*, January 23.

⁴ *New York Medical Record*, May 16, 1903.

the essential factors in their etiology is the presence of bacteria. As long ago as 1876 ('harcot and Gombault¹ found spores and bacteria in the bile after ligating the common duct in dogs. Netter,² after aseptic ligature of the common duct in rabbits, obtained cultures of bacteria from the bile. The staphylococci and streptococci were found by Netter and Martha (1886), Brieger, v. Leyden (1886), and others, in the human biliary passages, together with the bacterium coli communi. Naunyn, in his classical treatise on cholelithiasis, published in 1892, states that he had in the previous year gained the bacterium coli from the gall-bladder by a puncture during life in five cases of cholelithiasis. These historical statements are made because they seem to have been forgotten in the discussion during the symposium on gallstones at the Congress of American Physicians and Surgeons in Washington, May, 1903, and the original observations of bacterial findings in bile and gallstones erroneously attributed to others.

That the bile is chiefly excretory there can be no doubt, but this does not preclude the possibility that it may also in some way aid in the digestive process. The probable uses and functions of bile are given in my work, *Diseases of the Intestines*, vol. i. p. 48; more fully in the *American Text-book on Physiology*, and in Hammarsten's *Lehrbuch der physiologischen Chemie*. But we are by no means compelled to formulate opinions concerning everything we know or do not know regarding the probable digestive function of the bile. Much must be left for future physiological investigation. It is premature to deny every digestive action of the bile at the present time. Haller³ states that in the entire animal kingdom the bile-duct enters the intestinal canal near its beginning, and he suggests that this demonstrates that the secretion must be of some digestive importance. If it were not nature could have arranged the gall-ducts to discharge into the colon or rectum. The question, however, of the probable digestive function of bile has no direct bearing upon the question of the function of the gall-bladder. The gall-bladder has been considered a dangerous organ (1) because it is asserted that the gallstones are formed in it, and (2) because of its liability to disease. The first assertion, that gallstones are formed exclusively in the gall-bladder, disregards the fact that gallstones are found during operation and at autopsies in the intrahepatic bile-ducts. Beck's skiagrams proved the frequency of intrahepatic calculi, and these determined the frequency of recurrences of cholelithiasis even where the gall-bladder had been cleared of gallstones by operation. Cases are on record where the common gall-duct, the cystic duct, and the gall-

¹ Archiv. de phys. norm. et path., 1876, p. 453.

² Progrès médical, 1886, p. 992.

³ Elementa Physiologie.

bladder were entirely free of concretions, and only intrahepatic gall-stones were found.¹ Of course, such intrahepatic calculi may be due to a precursory bile stagnation and dilatation of the larger vessels above mentioned, but it shows the possibility of formation of such stones outside of the gall-bladder. *The great liability of the gall-bladder to disease is no proof of its uselessness, for if there were no gall-bladder all the infections which eventuate in cholelithiasis would travel directly into the hepatic substance and there give rise to much more serious inflammation. The gall-bladder interposes itself between the bacterial hordes of the intestine and the liver.* Moreover, let us assume what would happen in a simple catarrhal stenosis of the papilla of Vater. As long as the bile can flow out, although in never so reduced a quantity, it will not enter into the pancreatic duct, for the pressure in the duct of Wirsung is about equal or a little greater than that in the common gall-duct. The liver has very little or no elasticity, the intrahepatic vessels a small degree of elasticity. If the liver is considerably distended we get what is called a stagnation cirrhosis, an inflammation of the liver due to the backing up of bile—*Die "Gallenstaunungscirrhose"* of the Germans. This would probably happen every time a human being has an acute or chronic gastritis that extends to the duodenum, and what prevents it, perhaps numberless times in the life of every individual, is the gall-bladder, for when the papilla of Vater or the diverticula of Vater is stenosed by catarrhal swelling it offers itself up as a transient reservoir for the surplus of bile capable of being largely distended by virtue of its elasticity, and the more distended it becomes the greater is the intracystic bile pressure, which eventually may become so great as to expel an obturating plug of mucus or small concretion. Moreover, we know from the researches of Opie and others that bile once forced into the pancreatic ducts may give rise to pancreatitis. Here, again, the gall-bladder may offer itself up as a temporary safety-reservoir, saving both the liver and the pancreas from dangerous bile pressure. Possibly many times in our lives we have been saved from pancreatitis and cirrhosis by the gall-bladder, and we did not even know that we were threatened by such complications.

Because the gall-bladder can be removed surgically in patients having suffered from cholelithiasis by no means proves that it is a useless organ in the normal being. To the patient in whom gall-bladder resection becomes necessary this organ has more than likely done its duty many times over, and has become diseased in consequence thereof, and if eventually it is diseased in this manner it is of course better to

¹ O. Leichtenstern. Die intrahepatischer Cholelithiasis. Penzoldt's u. Stintzing's Handbuch d. spec. Therapie inn. Krankheiten, Band iv., part ii. p. 60.

remove it, just as it is better to remove a suppurating or dead tooth. Moreover, the remote history of such patients in which gall-bladder extirpation has been performed has not yet been carefully studied, nor their future experiences recorded. That they can live without a gall-bladder for a year or more under careful dieting and hygienic living does not prove that the gall-bladder has been a useless organ. It must be first seen whether at the autopsy of such individuals the liver has not after all become the fundamental cause of their death.

Hutchinson¹ thinks that we are coming to regard the gall-bladder as a possible source of intestinal or gastric disturbance in a very large percentage of our cases, particularly the motor disturbances of the stomach. He even goes so far as to suggest that in 70 per cent. of all forms of ulceration which will be found in three or four inches of the pylorus are in this region because infection could be readily diffused there from a leaking gall-bladder. Exactly the reverse of this is what I am disposed to conceive. Gastric disturbances are in the majority of cases not the result but the cause of cholecystitis, by virtue of an extension of the catarrhal gastritis into the duodenum. Except in the case of duodenitis due to cutaneous burns, all other forms are due to extension of acute or chronic gastritis or other anatomical alterations of the stomach. It is from this standpoint that we can recognize the practical value of prophylaxis. If all gastric catarrhs could be recognized and cured we should have very little catarrhal jaundice and hear very little of gallstones, for it is the duodenitis that predisposes to the infection of the bile-ducts. There may, of course, be infections of the duodenum from the lower regions of the intestines, as occurs in typhoid fever, the various dysenteries, and possibly as a consequence of appendicitis; but by far the great majority of the infections come from the stomach, as a careful anamnesis and record of chemical and microscopic analysis of the gastric contents have convinced me in the great majority of my cases of cholelithiasis.

Of course it must be admitted that stenosis of the pylorus can be due to adhesions set up by a diseased gall-bladder, and numerous examples of such cases have been operated by surgeons after my diagnosis pointing to this etiology was expressed; but even in such cases the original cause of the disease may have begun in the stomach. As to the etiology of gastric ulcers having anything to do with an infection from the gall-bladder, I need only refer to the standard text-books on diseases of the stomach to show the current opinion of clinicians and pathologists concerning the pathogenesis of peptic ulcer. The essential factor for the production of a peptic ulcer is a hyperactive gastric juice.

¹ Medical Record, May 16, 1903, p. 772.

They may occur in the lower œsophagus, where bile cannot enter except it is vomited. Adhesions of the pylorus with the gall-bladder and consequent stenosis of the pylorus, with possible gastric hemorrhages and perhaps also the vomiting of bile, may have given rise to this confusion that peptic ulcers could be due to gastric infection with bile. In cases of gastroptosis with almost constant presence of bile in the stomach I have never observed the development of a gastric ulcer.

Relation of Cholelithiasis to Acute Pancreatitis. Following the work of Eugene L. Opie, demonstrating that entrance of bile into the pancreatic duct could set up pancreatitis, J. Wiener, Jr.,¹ reports a case of acute pancreatitis due to cholelithiasis, and gives notes of thirty-two others. In all such cases an early exploratory laparotomy is the only correct course to pursue. The subject will be more minutely considered in the article dealing with pancreatic diseases.

The Medical Diagnosis of Affections of the Gall-bladder. Dr. John H. Musser² separates the primary and secondary affections of the organ. The primary are the catarrhal and infectious inflammations, neoplasms, and parasitic invasions by the echinococcus and round worms. The secondary affections are cholelithiasis, obstruction of the gall-ducts, and the suppurative inflammation of the gall-bladder and its surrounding vessels. Early recognition of the primary states would prevent the development of the secondary conditions. Of this there can be no doubt from what I have said concerning their pathogenesis in the preceding. Musser even went so far as to predict that in fifty years there would be little seen of these secondary conditions. As the management of the primary conditions is almost entirely clinical and not surgical, this emphasizes the value of the treatment of the derangements of the stomach and duodenum which generally precede cholelithiasis. Suppurative cholangitis, he said, was based upon a preceding development of gallstones or parasitic invasion. He has found leucocytosis in all the cases of suppurative cholangitis he has seen, and he calls attention to the occurrence of tenderness about the twelfth dorsal vertebra as an aid to the diagnosis to suppurative diseases of the biliary passages. The differential diagnosis must distinguish between abscess of the liver, congestion and engorgement, pyelophlebitis, subdiaphragmatic or subphrenic abscess, diaphragmatic pleurisy, pneumonia, disease of the pancreas, perforation and obstruction of the intestine. In connection with the tenderness about the twelfth dorsal vertebra, to which Musser refers, I must call attention to an article by I. Boas,³ in which he extends

¹ New York Medical Journal, May 16, 1903.

² Symposium of the Congress of American Physicians and Surgeons, Washington, May 13, 1903.

³ Beiträge zur Kenntniss der Cholelithiasis. Münchener med. Wochen., No. 15, 1903.

the dorsal area of sensitiveness to pressure over the entire posterior surface of the liver, from the two lower thoracic vertebræ to the first lumbar vertebra, and from the posterior axillary line to within 2 cm. to the right of the spinal column. This sensitiveness to pressure is of diagnostic importance for swelling of the liver as well as acute and latent cholelithiasis. Boas attributes his sign to perihepatic processes. In order to determine the various degrees of dorsal pressure sensitiveness we may make use of the faradic current, placing both electrodes near each other at congruent places. The dorsal sensitiveness may exceed in duration the acute attack of gallstone colic by several weeks or months, and during all this time the patient must be kept under careful surveillance. The emphasis which Boas lays upon the conviction that the pain is due to perihepatic (peritonitic) processes brings to mind the valuable paper of R. Tripier and J. Paviot.¹ The old view has been that the pain of hepatic colic is due to the passage of a gallstone, but the clinical and post-mortem observations of Tripier and Paviot led them to the conclusion that affections of the abdominal organs only give rise to painful crises when their enveloping peritoneum is acutely or subacutely inflamed, and that the pain varies inversely with the amount of the exudate. These authors, in a previous publication, have shown this to be true of the appendicular crises, and now assert that it holds good for hepatic colic, viz., that this pain is also due, in their opinion, to inflammation of the peritoneum in the region of the liver and gall-bladder, and the occasional clinical similarity of appendicitis and other inflammations by gall-bladder affections is thus easily explained by a propagation toward the appendix and other organs of a peritonitis having its origin in the environment of the gall-bladder.

These papers of Boas and Tripier and Paviot were not referred to in the paper by Dr. John H. Musser.

Etiology and Pathology of Gallstones. C. A. Herter's² report presents little that is new which cannot be found in the recent works on pathology and pathological physiology or clinical pathology.³ Herter has conducted experiments to see if it were possible to increase the cholesterin by the production of an artificial cholecystitis. It was found that by the injection of chemical irritants (mercuric chloride and phenol) the cholesterin could be increased from 0.12 to 0.298 or

¹ Concerning Peritonitic Pathogenesis of Hepatic Colic and Painful Epigastric Crises. *La semaine médicale*, January 28, 1902.

² Symposium of the Congress of American Physicians and Surgeons, Washington, May 13, 1903.

³ Hammarsten, *Physiologische Chemie*; Ribbert, *Lehrbuch der spec. Pathologie*; Krehl, *Patholog. Physiologie*; Naunyn, *Die Cholelithiasis*.

0.334). Herter is inclined to think that the bile may become infectious in infectious diseases like lobar pneumonia, and that this infectious bile of itself may set up infection of the gall-bladder. It is probable that any condition of cholecystitis bringing about a pathological alteration of the epithelium of the gall-bladder was liable to be attended by an increase in the amount of calcium in the bile, which, if it exceeded a certain quantity, would precipitate bilirubin calcium by combining with the bilirubin. The bacterial nidus of the gallstones, the original discovery of which he appears to attribute to Welch in 1890, was in reality first observed by Charcot and Gombault,¹ and later on by Netre and Martha, Brieger, v. Leyden, and Naunyn. An intensely interesting history of this bacteriological work on gallstones will be found in Naunyn's classical treatise on *Cholelithiasis*, translated by Archibald E. Garrod for the New Sydenham Society, pp. 46-52. In the above paper C. A. Herter emphasized that the two essential conditions for the formation of gallstones are the entrance of pathogenic micro-organisms and the stagnation of bile. With regard to the constitutional origin of gallstones, he had made some experiments on dogs, feeding them almost entirely with fat, and at the end of three months minute masses of bilirubin calcium were found in the gall-bladder, and in one instance there was a distinct concretion. He had never before met with such a concretion in over one hundred gall-bladders examined by him in other dogs. It is important to note out of deduction from this valuable report that it was possible to largely increase the quantity of cholesterolin, by means of chemical irritants, without the presence of an infection, and, secondly, that constitutional conditions may bring about such chemical changes in the bile, that it constitutes an irritant to the bile passage, may play an important part in the pathogenesis of cholelithiasis.

Diseases of the Gall-bladder and Bile-ducts with Special Reference to Diseases of the Stomach and Intestines. This subject was considered by Prof. C. A. Ewald,² of Berlin. Under this heading one would naturally expect to find a presentation of those abnormal conditions of the stomach and intestine which could be productive of disease of the gall-bladder by causing disease of the mucous membrane of the duodenum, for considered from the standpoint of topography the pathogenesis of cholelithiasis could be considered from two aspects: (1) the catarrhal extensions and bacterial invasions from the duodenum causing disease of the epithelium of the biliary apparatus; (2) metabolic or

¹ Archiv d. Physiologie normal und Pathologie, 1876, p. 543.

² Symposium of the Congress of American Physicians and Surgeons, Washington, May 13, 1903.

chemical changes in the excretion of the bile caused by infectious diseases or altered metabolism, as pointed out by C. A. Herter,¹ and changing the quality of the bile chemically so as to constitute an irritant. Ewald has found the internal treatment of cholelithiasis very unsatisfactory, and he looked upon the surgical treatment of this disease as being very much in the same position as that of appendicitis. Not all cases of appendicitis were necessarily to be treated surgically, and the same is true of cholelithiasis, in Ewald's opinion. He also emphasized that even by operation one could not be sure of a recurrence, which is quite intelligible when one reflects that with removal of the gallstones we do not remove the disease, but the result of the disease. If the disease itself is remediable—for instance, infection of the gall-bladder—it is possible to cure this by surgical means; but if it is due to some metabolic and chemical change in the secretion of the bile, I do not see how a surgical operation could cure it, although even in such cases the surgical removal is an absolute necessity in order to prevent further complications (pancreatic disease). But after such operations the patient should be recommended to the care of a competent clinician to make a study of his metabolism, and by examination of the stools and stomach contents keep informed concerning the state of the gastrointestinal canal.

The Medical Treatment of Cholelithiasis. From what we have learned in the preceding we may conclude that the radical treatment of cholelithiasis is not identical with the removal of the gallstones, but with the healing of the inflammatory process or infection that has either travelled up from the duodenum or the metabolic abnormality which has changed the composition of the bile. This is proven by the fact that gallstones may re-form after their surgical removal, and, again, by the fact that spontaneous cures may occur where the stones remain in the gall-bladder and are found there after death from some other disease, the patient never having complained of the symptoms of cholelithiasis. Riedel² states that in Germany 2,000,000 human beings carry gallstones in their gall-bladder, but of these only 100,000 have cholelithiasis. Evidently there must be self-healing mechanisms in the hepatic and biliary apparatus whereby the gall-bladder, far from being always a menace to life and a useless organ, may actually be a preserver of life by retaining and holding gallstones, which, if they moved out of it, would become dangerous. Ludwig v. Aldor³ gives the internal treatment of gallstone disease, laying especial stress upon the Carlsbad

¹ Loc. cit.

² Penzoldt u. Stintzing's Handbuch d. Therapie, Band iv.

³ Die innere Behandlung der Gallensteinkrankheit. Archiv f. Verdauungs-krankheiten, Band iii. p. 622.

cure, which is, however, in this case, employed in an entirely different manner from that usually recommended. The stereotyped Carlsbad cure includes extensive physical exercise, long walks, together with the drinking of the water. It is this physical exertion which may actually induce an attack of hepatic colic by starting the exit of a stone from the gall-bladder into one of the ducts, and explains the impressions gained by Carlsbad patients that a Carlsbad cure is effected only at the expense of several attacks of hepatic colic. No doubt many of these patients who are ordered to take long walks on the seductive serpentine promenade of Carlsbad have circumscribed peritonitis, and their condition is only made worse by the exercise. Ludwig v. Aldor keeps his gall-stone patients in bed from 7 o'clock in the morning until 12 o'clock, and from 2 o'clock in the afternoon until 7 o'clock in the evening, applying hot external applications in the shape of comfortably fitting zinc abdomen warmers. Every two hours the patient drinks from 150 c.c. to 200 c.c. Sprudel Wasser of 55° C. The daily quantity consumed varies from 700 c.c. to 1½ litres. The patient is not directed to starve himself, but receives a mixed and quite liberal diet, excluding only the highly seasoned, spiced, and stimulating food. This simple rest treatment is kept up until all sensitiveness to pressure over the hepatic region has disappeared. The time required for this treatment was five weeks in the majority of cases. Ludwig v. Aldor does not claim that the Carlsbad waters have a stimulating effect on the secretion of bile, nor that they can dissolve gallstones, and, therefore, I may be permitted to suggest that we Americans do not need the Carlsbad water at all for this purpose, and could carry on the treatment as well with the Saratoga Carlsbad or the magnesia spring of Bedford, Pa.

F. Blum¹ speaks very highly of the sodium oleate which has been brought into commerce, under the name of "eunatrol," for stimulating the secretion of bile in cholelithiasis. He associated this remedy given in the form of chocolate-coated pills, in doses of 0.25 gm., with high enemas of olive oil.

We have hitherto only recognized two remedies as having influence in stimulating the bile, namely, the bile salts and the salicylate of sodium. A. Chauffard² lauds the salicylate and the benzoate of sodium as the best remedies for the internal treatment of cholelithiasis. He combines it with the internal use of Harlem oil, giving the salicylate of sodium in daily doses of 1 gm. or 2 gm. (15 gr. or 30 gr.) in conjunction with an equal amount of sodium benzoate. This medication is given ten to twenty days every month for many months, even years.

¹ Die ärztliche Praxis, 1902.

² Du traitement médical préventif des coliques hépatiques à répétition, Hôpital Cochin. La semaine méd., 21e année, No. 1.

Only by great persistence can the desired results be effected, and Chauffard considers the treatment so beneficial that most cases of cholelithiasis in his experience were healed without surgical intervention.

The great danger of the complications of cholelithiasis—pancreatitis, carcinoma of the gall-bladder, peritonitis, hepatitis, etc.—should make us especially skeptical with regard to such claims; and although the symptoms of cholelithiasis may be much improved by internal treatment, the life of the patient is safer with the gallstones removed surgically.

Diagnosis of Liver Diseases. A very able article on the "Differential Diagnosis of Certain Diseases of the Liver" is published by Charles G. Stockton.¹ This paper treats first of the differential diagnosis between *cirrhosis of the liver* and so-called *syphilitic cirrhosis of the liver*. In this paragraph Stockton defines his interpretation of the terms hypertrophic and atrophic cirrhosis. When the round-cell infiltration is specially intralobular it is said to be characteristic of hypertrophic cirrhosis, and clinically in such cases one would expect to find the liver increased in bulk and ascites present. On the other hand, when the connective tissue grows for the most part in the interlobular spaces around the radicles of the portal veins, and to some extent cuts off the supply of the portal blood to the liver, it is said to be characteristic of atrophic cirrhosis, and clinically one would expect to find in such cases the liver decreased in bulk and ascites present. Aside from the questionable method of arguing retrogressively—that is, from the post-mortem appearances to the clinical phenomena—these deductions present other debatable features, and, as Stockton emphasizes, the distinction between atrophic and hypertrophic cirrhosis is for the most part an academic question. Whether the changes described are intralobular or perilobular, an atrophy of the hepatic parenchyma is actually met with in both states, as Councilman has pointed out. From Stockton's description one would be strengthened in the belief that without the therapeutic test, namely, the administration of mercury and the iodides, the distinction between syphilitic cirrhosis and other forms of cirrhosis of the liver would be impossible. He admits that a transient benefit may come to non-syphilitic forms of cirrhosis of the liver from this treatment. If the assertions of the French writers are true, that the iodides and mercury will greatly improve any form of cirrhosis except that due to malignant tumor, then the therapeutic test is of little value as a diagnostic factor unless it is coupled with an undoubted specific history of the patient.

The second paragraph of this paper deals with the diagnosis between

¹ American Medicine, February 14, 1903.

cholelithiasis and *cancer of the liver*. In this section Stockton deals extensively with the publication of Hans Kehr, who emphasized that jaundice was absent in 80 per cent. of his cases of gallstones. *Courvoisier's law* is emphasized, viz., that when a stone is held at the juncture of the cystic and hepatic ducts the gall-bladder is even less likely to be enlarged, and when the concretion is retained at the outlet of the common gall-duct the enlargement of the gall-bladder is almost invariably absent. Courvoisier's law is practically as follows: The presence of jaundice with enlargement of the gall-bladder suggests cancer; on the other hand, with a history of gallstones and with the gall-bladder not palpable it suggests stone in the common duct. In cancer there is often very little evidence of inflammatory reaction, which state is so commonly observed in cholelithiasis. We must not expect to make a positive diagnosis in all cases, even when one of the affections is unaccompanied by the other; but if we remember what has been said about the diagnosis of gallstones and recall that in cancer we generally find the liver large, jaundice present, the gall-bladder increased in size and palpable, a marked secondary anæmia and cachexia present, fever and biliary colic absent, Stockton thinks that we should usually be able to distinguish between these two affections.

The third section deals of the differential diagnosis between *cholecystitis* with *angiocholitis* and *abscess of the liver*. Of course, cholecystitis accompanied with angiocholitis may closely resemble suppurative hepatitis, and a diagnosis which would limit all possible hepatic disorders down to these two would under certain conditions not exactly be a bad diagnosis. Nevertheless, Stockton gives us some valuable hints which make even this differential diagnosis possible. The anamnesis is important for hepatic abscess. Dysentery and typhoid fever have been known to give rise to it. A previous history of attacks of pain and other characteristic phenomena previously mentioned is suggestive of cholecystitis.

In angiocholitis jaundice is most invariably present. Jaundice is rarely present with abscess of the liver, and in the exceptional cases in which it does occur it is due to an accompanying angiocholitis or pressure upon one of the larger bile vessels. Stockton is enthusiastic on the efficacy of puncture for the diagnosis of abscess of the liver. He has seen no injury come even from repeated punctures of the liver. His chief factors in the diagnosis for hepatic abscess are the following: Enlargement of the upper rather than the lower border of the liver, inflammation of the pleural cavity, jaundice more frequently slight or absent, may possibly be severe; tenderness, possibly perihepatitis; fever of varying type, leucocytosis, previous history as to causation, and, finally, the outcome of puncture.

In the fourth and last section of this interesting paper Stockton speaks of the differential diagnosis between the *sclerosis of the liver* following chronic biliary obstruction and the so-called *Hanot's sclerosis* of the liver. There can be no doubt that these are two distinctive forms pathologically, but whether or not they can be separated clinically is doubtful.

In the discussion of Hanot's cases by Charcot, the latter accounted for the hepatic changes by the angiocholitis that existed, and explained the increase in the size of the liver, and the fatal termination, by the retention of bile which resulted; this explanation of Charcot made things worse, in Stockton's opinion. He states: "Undoubtedly the confusion was worse confounded by Charcot's discussion." The clinical distinction between *hypertrophic cirrhosis* of the liver and *Hanot's cirrhosis* of the liver is a diagnostic conundrum which Stockton bravely attempts to solve. In the former we have to deal with a condition which results from obstruction to the bile-ducts from any cause whatsoever—from obstructing gallstones, adhesions, pressure from tumors, or long-continued inflammatory processes involving the biliary channels; and no matter from what cause we have a resulting stasis of bile, moderate enlargement of the liver, jaundice, with the usual symptomatology of cholæmia. Some cases are complicated by connective-tissue changes, such as occur in simple atrophic cirrhosis, and in such instances ascites appears. On the other hand, ascites may be absent, while the jaundice remains intense. The features that are characteristic are continued jaundice, usually marked in character, moderate enlargement of the liver, with little or no change of the spleen.

Stockton promises us a future publication on *Hanot's cirrhosis*, but for the present recalls these diagnostic facts: A young person is suddenly attacked with abdominal pain, who has a very large, sharp-edged, smooth liver, having at the same time a very large spleen and accompanying jaundice, but no ascites; that he afterward improves, but the liver and spleen continue increasing in size, the jaundice never quite disappearing, but increasing from time to time, usually synchronously with elevation of temperature. Observe that this is a very chronic condition; that it is free from a history of alcoholism or other known cause of disease, and that though it may persist for several years the fatal outcome in icterus gravis is assured if we are to be guided by the history of recorded cases.

Another very recent publication on the "Diagnosis and Treatment of Gallstone Disease" is by D. D. Stewart,² of Philadelphia. Stewart

¹ American Medicine, February 15, 1903, p. 255.

² American Journal of the Medical Sciences, May, 1903.

has brought together a group of highly interesting cases of *catarrhal cholecystitis* with and without obstruction, of *dropsy of the gall-bladder* or *pericholecystitis* with adhesions, of *chronic obstructions of the common gall-duct by stones*, with what he calls the "usual" accompanying jaundice and shortened gall-bladder. From what has been pointed out in the previous papers, however, jaundice is not so "usual" in obstruction of the common gall-duct. Stewart's report is mainly one of casuistic nature, and must be read in the original to be appreciated. Regarding surgical interference in catarrhal cholangitis without presumed obstruction of the duct, he advises one or two seasons at Carlsbad if there is no family history of cancer. If the cholecystitis is recent and of mild type, and there is no persistent recurrence, he regards surgical intervention as yet unnecessary. With evidence of cholecystitis he regards the case as a surgical one immediately. He seems to be very fond of Carlsbad water, or the Carlsbad salt in powder or crystal form, especially for douching the stomach in gastric atony accompanying cholecystitis. He has discontinued the use of olive oil in obstructions of the common bile-duct by stones. The last paragraph of the paper is devoted to preparatory treatment before operation in obstruction of the common bile-duct by stone.

DISEASES OF THE PANCREAS.

The Anatomy and Physiology of the Pancreas. The most recent and at the same time the most valuable contribution to this subject is a monograph by Dr. Eugene L. Opie.¹ I will pass over the description of the embryology and development of the pancreas as not of absorbing interest to the clinician. In his description of the two ducts, the larger one the duct of Wirsung, which enters the intestine in company with the common bile-duct, and the smaller or accessory duct, that of Santorini, which terminates in the papilla situated nearer the stomach than that of the larger duct, he emphasizes that the duodenal orifice of the accessory duct is very minute and joins the duct of Wirsung, into which, doubtless, it pours its contents in the great majority of individuals. Opie has dissected the ducts after injection in one hundred subjects. The two ducts were present in every instance, but one or the other was occasionally so small that it was found with difficulty. In ten of the one hundred instances the two ducts failed to anastomose within the gland, and in four additional subjects the two ducts were united by such a minute branch that they might be regarded as inde-

¹ The Anatomy of the Pancreas. American Medicine, June 20, 1903, p. 996; also journal articles by same author.

pendent of one another. In twenty instances the duodenal end of the duct of Santorini was not patent. Thus these figures demonstrate that in at least two-thirds of all individuals the duct of Santorini cannot act as an accessory outlet when the duct of Wirsung is occluded. In a considerable number of specimens the orifice of the duct of Santorini, though patent, was so minute that its functional significance was slight, and in eleven of the one hundred specimens the duct of Santorini, on the contrary, was equal in size or larger than the duct of Wirsung, so that during life it was doubtless the outlet for the larger part of the pancreatic juice. The two ducts unite to form the short common channel, the diverticulum of Vater, which is subject to almost as much variation as the pancreatic ducts themselves. In eleven instances of the one hundred subjects examined by Opie no diverticulum was present, and the two ducts entered the duodenum separately at the summit of the bile papilla. The duodenal orifice of the diverticulum of Vater had an average diameter of 2.5 mm., and the length of the diverticulum varied from 1 mm. to 11 mm., and only in thirty of the one hundred specimens did the length equal or exceed 5 mm. These dimensions are significant, because they show that a calculus which has become impacted within the orifice will completely fill the diverticulum and occlude both ducts.

Physiologists and pathologists are now more and more appreciating the two functionally diverse elements of the pancreas. First, cells which supply the intestine with important digestive ferments—those which are concerned in the manufacture of pancreatic juice—and, secondly, cells having no communication with the ducts of the glands, but in intimate relation with the bloodvessels, and producing an internal secretion concerned in carbohydrate metabolism. Cases have from time to time been reported in which it was claimed the entire pancreas had been destroyed by disease, and yet the carbohydrate metabolism did not appear disturbed. We can understand how the stomach and intestines may step in and take up the digestive functions of the pancreas vicariously, but this is not intelligible as far as the internal secretion is concerned. In such cases where the pancreas is apparently destroyed the maintenance of normal carbohydrate metabolism might be explained by the discovery of Helly, who found lobules of pancreatic parenchyma situated within the papilla of the duct of Santorini, and also immediately below the duodenal mucosa. Occasionally these misplaced portions of pancreatic tissue were provided with an independent duct, and constituted a true accessory pancreas.

In 1800 autopsies performed at the Johns Hopkins Hospital small masses of aberrant pancreatic tissue were found by Opie imbedded in the wall of the stomach or of the intestine in ten cases at a variable

distance from the pancreas. In two instances two accessory glands occurred in the same individual. These accessory and aberrant pancreatic glands may in exceptional cases explain the maintenance of normal carbohydrate metabolism in those exceptional cases where the pancreas was reported apparently entirely destroyed.

Proceeding to a consideration of the histology of the pancreas, Opie graphically describes the ferment-secreting cells, which are large and contain zymogen granules, presenting characteristic variations during different stages of secretion, and forming the secreting acini. Scattered among the secreting acini, and several times the size of a single acinus, are the round, oval bodies composed of polygonal cells grouped together to form short, tortuous columns, which unite with one another in such a way that space is left for a network of wide capillary bloodvessels. These interacinar islands are surrounded by capillary vessels which, when injected, appear tortuous, dilated, and resembling the glomeruli of the kidneys. These islands of Langerhans consist of columns of cells in intimate relation with a rich vascular supply, and having no communication with the pancreatic ducts. They are ductless glands resembling the adrenal and parathyroid bodies. They are not concerned in the elaboration of the pancreatic ferment, and abundant evidence has shown that the islands of Langerhans exert an influence upon the carbohydrate metabolism through an internal secretion. Opie describes the pancreas of a child who died of diabetes. The disease in this case was hereditary, and affected six members of the same family. The number of the islands of Langerhans was only a third of that usually and normally present. It suggests the possibility that diabetes will occasionally be the result of a congenital anatomical defect in the pancreas.

Chronic Indurative Pancreatitis. S. M. Melkich¹ reports two highly instructive cases of chronic pancreatitis. The true nature of the malady, however, was ascertained at the laparotomy. In a female, aged thirty-eight years, the principal symptoms were those of bile retention. In another, a woman aged twenty-two years, among many other symptoms the most poignant were violent attacks of colic with considerable elevation of temperature. This writer, in agreement with a former publication by myself,² and a very instructive paper by Reginald H. Fitz, to be reported in the following, asserts that the diagnosis of chronic pancreatitis presents immense difficulties and is, as a rule, not recognized before the autopsy. According to Melkich, this disease is either caused by alterations in the bloodvessels on the basis of alcoholism, syphilis, or arterial sclerosis, or, secondly, by bacterial and catarrhal processes, the latter frequently associated with formation of

¹ *Praktischeski Wratsch*, 1902, Nos. 38-41.

² *International Clinics*, 1902.

concretions in the excretory ducts. If we can establish the coexistence clinically of diabetes steatorrhœa and azotorrhœa in addition to a palpable enlargement of the head of the pancreas we should suspect an involvement of this organ. Unfortunately, these symptoms are rarely present simultaneously. He finds that the most constant clinical sign is tumor in the particular abdominal region—that is, a swelling of the head of the pancreas—which means that phenomena of pressure resulting therefrom—for instance, compression of the pylorus, icterus, passive congestion in the portal-vein system, ascites, and enlargement of the spleen, œdema of the lower extremities, and cœliac neuralgia—are provoked by pressure caused by increase in volume of the head of the pancreas. The differential diagnosis must consider the distinction from *catarrhal icterus*. A particularly stubborn icterus accompanying a palpable tumor in the region of the pancreas speaks for pancreatitis. An existing pancreatitis may simulate cholelithiasis. Here the following argument seems logical: chronic and slowly increasing icterus with simultaneous colics, enlarged gall-bladder with symptoms of protracted cholelithiasis, and an olive-green or yellowish discoloration of the skin speaks for pancreatitis, especially so when at the same time a tumor can be palpated in the pancreatic region. If carcinoma of the pancreas can be excluded and an operation produces improvement, these consequent effects of the laparotomy confirm the diagnosis of chronic indurative pancreatitis.

Pancreatic Disease Simulating Cholelithiasis. Since the work of Opie the physiological, embryological, and pathological relationship between the pancreas and liver has been more carefully studied. Worobjew¹ also emphasizes that the pancreas frequently participates in diseases of the liver, and, what is more important to know, it may closely simulate hepatic disease, particularly cholelithiasis. A complete clinical picture of gallstones may thus be present, due exclusively to chronic disease of the pancreas. Infrequently, also, both organs are affected, and we have reasons to surmise that the classical symptoms of biliary calculi are only in part due to the latter, the pancreatic component entering largely into the clinical picture. For the physician, and still more so for the surgeon, these facts carry the greatest weight. It has occurred that an operation was performed for “gallstones,” and stones were removed from the gall-bladder, yet no improvement resulted, and at the autopsy calculi were discovered in the pancreas. Symptoms pointing to pancreatic involvement (chronic inflammations, calculi, etc.) are: (1) colicky pains in the left hypochondrium, unaccompanied by jaundice; (2) diabetic manifestations, chiefly, rapid

¹ Chirurgia, January, 1903.

emaciation; (3) fatty evacuations; (4) salivation; (5) tumefaction and resistance in the region of the pancreas, and (6) the appearance of calculi in the stools following attacks of colicky pains, the calculi consisting of carbonates and phosphates of lime. As to treatment, narcotics are of value in pancreatic colic. Pilocarpine hypodermically and pancreatin internally deserve a trial, but in the event of failure recourse should be had to surgical measures.

In recent American literature two cases of *pancreatitis due to preceding cholelithiasis* are reported, one of acute pancreatitis with fat necrosis, by H. Monks and David B. Scannell, which terminated fatally after the operation. The pancreas and the left suprarenal body were disintegrated by fatty necrosis. The second case was one of chronic pancreatitis, and is reported by Harding.¹ It occurred in a woman, aged forty-nine years, who had previously had both breasts removed for cancer. The symptoms came on acutely, and consisted of severe pain in the epigastrium, lasting for four hours. Attacks of pain occurred every third day, associated with fulness in the stomach and frequent eructations of gas; jaundice, nausea, constipation, and neurasthenic symptoms were present. At the operation the pancreas was found enlarged and nodular, which led to the suspicion of cancer. A small piece of the pancreas was examined, but showed simply chronic pancreatitis and no cancer. Nothing was done except to open and drain the gall-bladder, and the patient recovered entirely.

Both of these recent cases from American literature emphasize the necessity of exploratory laparotomy as soon as such conditions are suspected.

Diabetes and Diseases of the Pancreas and Liver. Steinhaus² reports autopsy findings in twelve cases of cirrhosis of the liver. In eleven of these chronic interstitial inflammation of the pancreas was found. The character of the inflammation is not described with the same exactness that Opie gives to this subject. It is said to be a chronic interstitial inflammation of the pancreas similar in each case to the condition found in the liver of the same subject. The islands of Langerhans were found affected in only one case. The diminished tolerance for sugar frequently observed in cirrhosis of the liver is, therefore, probably due to the implication of the pancreas and not to the liver condition. It is not necessary to classify separately the glycosurias accompanying cirrhosis of the liver, arteriosclerosis, pancreatic disease, etc. Rather it is to be inferred from all recent investigations that every case of glycosuria is probably due to some disturbance in

¹ Washington Medical Annals, November, 1902, p. 357.

² Deutsche Archiv f. klin. Med., Band lxxiv., Heft 5 und 6.

the functions of the pancreas, and that this organ alone controls the carbohydrate metabolism of the organism.

Symposium on Pancreas and Pancreatic Disease. This symposium was led chiefly by E. L. Opie,¹ of Baltimore, on the anatomy and histology which we have already abstracted in the preceding. A second paper was the physiology and physiological chemistry, by Prof. R. H. Chittenden, of New Haven, who dwelt upon the two distinctive functions of the pancreas. He referred to the work of Bayliss and Starling, which we have already abstracted in the preceding. These observers separate from the duodenal mucosa a substance which they call "*secretin*," which converts the zymogens of pancreatic juice into active ferments. I wish to remark that these researches of Bayliss and Starling (see the report in the section on Physiology of the Intestines) have recently been confirmed by two French experimenters, Enriquez and Hallion,² who extend the physiological effects of secretin, and assert that it is not a specific stimulant for pancreatic secretion, but also stimulates the secretion of bile. They also assert that an acid as well as bicarbonate of soda, two antagonistic chemicals (acid and base), will produce an abundant flow of bile and pancreatic juice when brought upon the mucosa of the duodenum in dogs that have a duodenal fistula.

Chittenden does not furnish in his report satisfactory evidence that the cells of the islands of Langerhans have an internal secretion. The cells of the pancreas have more pentose than the other cells in the body. Chittenden called attention to the results of Herter and Wakeman concerning the adrenalin glycosuria, and the reducing action upon the pancreatic cells. The fact that many organs of the body might form reducing substances which might reach the pancreas in the blood stream threw a new light on the origin of diabetes. However, Herter and Wakeman³ found that not only reducing substances but also oxidizing substances could cause glycosuria. Adrenalin when brought upon brain, liver, spleen, or kidney also produces increased excretion of sugar, and they could not positively prove whether or not this adrenalin had been absorbed into the general circulation and, after all, produced its effect by acting upon the pancreas, for to decide this it would have been necessary to extirpate the pancreas—a procedure which in itself inevitably causes glycosuria. So the present state of the physiology of the pancreas gives us no new and precise information on these important questions.

¹ Congress of American Physicians and Surgeons, Washington, May 12, 13, and 14, 1903.

² Recherches nouvelles sur la "*secretine*," Action sur le foie, Presse médicale, No. 7, 1903.

³ American Journal of the Medical Sciences, January, 1903.

The experiments of Herter and Wakeman would receive a new interpretation if the statements of Poehl¹ could be confirmed concerning the derivation of the substance known as adrenalin. Poehl asserts that this substance does not by any means occur only in the adrenals, but in all other organs and tissues of the body. Poehl attributes the priority of having discovered adrenalin in 1892 to Kondratiew, who, it is claimed, made a strong solution of it from the spleen of animals. As long as the adrenalin is in the nucleus of the cells it is not only harmless, but of advantage to the organ. The poison leaves the cell, according to Poehl, when the juices of the organism become acid, which can occur from certain forms of anæmia and diabetes. To avoid this exclusion of the poison from the cells the alkalinity of the juices must be restored.

Symptomatology and Diagnosis of Diseases of the Pancreas.²

The most valuable paper, from a clinical standpoint, that was contributed to the symposium,³ was that on the symptomatology and diagnosis of disease of the pancreas, contributed by Prof. Reginald H. Fitz,⁴ of Boston. Fitz began by a reference to the work of Friedreich in 1875.⁵ According to Friedreich, no single symptom which may occur in diseases of the pancreas is pathognomonic, and the occurrence of several does not always result in a positive diagnosis. Fatty stools, melaturia, epigastric pain, with the characteristics of celiac neuralgia and palpable tumor, lead among the symptoms most useful in diagnosis, and then follows a remarkable statement of Friedreich, which I have since his publication occasionally seen erroneously attributed to others, viz., "The presence of undigested striated muscle fibres in the fæces is worthy of every consideration, and may prove of diagnostic value." Fitz agrees with other authorities that the symptoms and signs especially suggestive of pancreatic disease are dependent largely upon the resulting disturbances of (1) its functions and (2) upon the situation of the organ. The former include the various modifications in the composition of the urine and fæces; the latter comprise the localized resistance, tenderness, and pain, and the evidence of obstruction of the gastrointestinal and biliary tracts. The demonstration of sugar in the urine, of visible fecal fat, or undigested muscle fibres in the fæces often led to the assertion that pancreatic disease was present when one or more of these conditions had been determined. But when the results of clinical observation were compared with anatomical investigation it became evident that

¹ Die neuesten Untersuchungen über die chemischen Lebensprozesse in Verbindung mit der Frage der Bedeutung des Adrenalchlorids (Adrenalin). Russki Wratsch, 1903, No. 13.

² PROGRESSIVE MEDICINE, June, 1902, p. 111; December, 1902, pp. 60-64.

³ Congress of American Physicians and Surgeons, Washington, May, 1903.

⁴ American Medicine, June 6, 1903, p. 907.

⁵ Ziemssen's Handbuch der speziellen Pathol. u. Therap.

diseases of the pancreas occurred much more frequently without the recognition of glycosuria and excessive fat and muscle in the *fæces* than when these abnormalities are evident. If diabetes is associated with long-continued bronzing of the skin and enlargement of the liver, in the absence of jaundice and the characteristic distribution of the pigment in Addison's disease the suggestion is direct that chronic fibrous pancreatitis is present. Anschütz has tabulated twenty-four cases of complication since the original publication by Hanot and Chauffard on this subject (the bronzed diabetes of the French writers).

In this paper by Fitz there is a table to show the relation between visible fecal fat, jaundice, and pancreatic disease. Only those cases are included which gave anatomical changes at autopsy, a laparotomy, or by passage of a pancreatic calculus, that there was actual disease of the gland. Without going into the details of figures the table suggests that in about three-fifths of the cases of steatorrhœa attributable to pancreatic disease there is neither diabetes nor jaundice; that in two-fifths there was either diabetes or jaundice in about equal proportions, and in but few instances is there a combination of diabetes and jaundice. In another table the view of Müller is brought out that in pancreatic disease there is less splitting of fat and consequently an increase in the neutral fat, thus giving a satisfactory explanation of the oily stools of older writers. This is not the case without exception, however. The possibility is that the *fæces* may contain an excess of fat not only in cases of jaundice, but also when there is superabundance of fat in the stools, and also when there is an abnormality of the absorptive function within or without the intestinal wall. Steatorrhœa is, therefore, to be regarded as an evidence of disease of the pancreas only when other causes for its presence can be excluded, the most important of which is interference of flow of the bile into the intestine.

Fitz emphasizes that any disturbance in the digestion and assimilation of fat, muscle, and carbohydrates from affections of the pancreas has almost invariably been connected with extensive and protracted lesions. It is obvious, therefore, that feeding with an increased quantity of one or the other of these constituents of diet in suspected cases of pancreatic disease might be followed by appreciable changes in the secretions and excretions earlier than otherwise would have been the case. It is clear, also, that disturbances in the digestion of fats, starches, and proteids, relieved by the addition of the pancreas or its preparations to the diet, provided disease of the digestive glands could be eliminated, might furnish additional evidence in favor of the pancreatic source of the disturbance.

Regarding the dietetic experiment of testing the functions of the pancreas, Fitz agrees with the view of increasing the quantity of fat in the diet nearly to the limit which is to be reached without producing

steatorrhœa in healthy persons or in patients not suffering from disease interfering with the absorption of fat. It would be particularly desirable to know the toleration of fat in those cases of diabetes in which the pancreas presents no abnormal condition. These methods require the trained chemist. In a like manner the capacity of the patient for digesting muscle fibre in the intestine as compared with that of a normal individual should be tested. Of course, this would necessitate that we should first know the condition of the gastric function, and that we should introduce into the intestine muscle fibre as free as possible from the influence of gastric digestion.¹ The efficiency of the pancreas for digesting the starches might be tested by an experimental alimentary glycosuria. The salol method of Ewald and Sievers and the glutoid iodoform capsules of Sahli are chemical methods of doubtful efficacy in the diagnosis of pancreatic disease. Opie² has suggested the possibility of discovering in the urine the fat-splitting ferment set free in acute pancreatitis. He endeavored to determine its presence in one case by following the method proposed by Kastle and Loevenhardt, which is based upon the decomposition of ethyl butyrate by the ferment and the production of butyric acid. The urine neutralized with potassium hydroxide was divided into two portions, one of which was boiled for the purpose of destroying the ferment. Ethyl butyrate was added to each specimen. That unboiled after twenty-four hours gave an acid reaction, while the boiled specimen showed little if any change.

The symptoms and signs which have proved most useful, according to Fitz, in the diagnosis are those which call attention directly to the region of the pancreas. They are epigastric pain, tenderness, tension, and tumor, with or without obstructive jaundice, and evidence of mechanical interference with the motility of the stomach and duodenum. Although the diagnosis of diseases of the pancreas, in the light of our present knowledge, depends practically more on the symptoms calling attention to the locality of the organ than upon the evidence of disturbance of its function, it is reached eventually by the exclusion of other sources than the pancreas, as causes of the local symptom. Fitz refers to his publication on acute pancreatitis made in 1889, and repeats that the symptoms are essentially those of a peritonitis beginning in the epigastrium, and occurring suddenly during ordinary health without obvious cause. The diagnosis is based on the pain, tenderness, and tympany limited to the region of the pancreas, and on the gradual development of deep-seated peritonitis.

¹ Ground meat pulp might be introduced into the duodenum by Hemmeter's or Kuhn's method of duodenal intubation.

² Johns Hopkins Hospital Bulletin, 1902, vol. xiii. p. 117.

The differential diagnosis lies practically between an irritant poison, perforation of the digestive or biliary tracts, and acute intestinal obstruction. In cases of acute pancreatitis thus far reported no new evidence has been furnished which gives to the diagnosis more than a variable degree of probability. Certainty has been reached only by laparotomy or a post-mortem examination. Fortunately, exploratory laparotomy has proved the most satisfactory method of treatment for relief of acute symptoms in an increasing number of cases.

The diagnosis of *chronic* pancreatic affections is based on the occurrence of localized pain and presence of tumor; the evidences of disturbed pancreatic function are to be sought along the lines previously mentioned, but experience has shown that definite and convenient additions to our knowledge are necessary before functional disturbances of the pancreas can be ascertained sufficiently early and with sufficient certainty to render assured the pancreatic source of the disease.

DISEASES OF THE PERITONEUM.

It is evident that a presentation of diseases of the peritoneum considered from the purely clinical standpoint in a work which will contain presentations from the surgical, gynecological, and purely bacteriological aspects must necessarily be very limited; for if we exclude those forms of peritonitis that are due to infection originating (1) from the gastrointestinal tract (perforations of the stomach and intestine, appendix); (2) peritonitic infections originating from inflammations of the biliary apparatus; (3) and those traceable to infections from the genito-urinary tract (kidneys, uterus, tubes, and ovaries)—all of which are surgical problems—not much is left for the purely internal clinician. One cannot fail to be impressed with the rapid progress that has been made in the recognition and more rational treatment of the various forms of peritonitis, and it is a just desert of especially American surgeons that the most of this progress has been due to their efforts. In a number of the forms of peritonitis due to infection from the sources above mentioned there can be no doubt whatever that the cases belong to the field of the surgeon. This is particularly true of the peritonitis due to perforations of the gastrointestinal tract and cholelithiasis. On the other hand, it must not be claimed, as some ultra-ambitious surgeons would lead us to believe, that the clinician has no occasion to treat peritonitis whatever. One of the ablest surgeons¹ with whose work I am acquainted treats a very large number of his cases of peritonitis by a purely ex-

¹ A. J. Ochsner. Surgical Treatment of Tuberculous Peritonitis. Transactions of American Surgical Association, 1903.

pectant and internal treatment. Even in the treatment of appendicitis Ochsner has become more conservative, and does not operate at once or at any time in all cases. His aim is now to change the acute cases, in which the mortality of operation is greatest, into another class, in which the mortality is very small after operation. This he effects by conservative treatment, involving chiefly gastric lavage, exclusion of food from the mouth, exclusion of cathartics by the mouth, and rest. He advocates quenching the thirst even, by rinsing the mouth with cold water and the use of small enemata.¹

Physiology of the Peritoneum on the Protecting Action of the Omentum. It has long been supposed, on theoretical grounds, that the omentum in some way controls the blood pressure of the abdominal organs, because it is able to take up a very large amount of blood in its spacious blood channels and without suffering any detriment, which must necessarily occur if the same engorgement had to take place in one of the abdominal organs. De Renzi² described the results of his experiments, which tend to prove that the omentum plays an important rôle in maintaining the activity of the circulation of the abdominal organs, particularly that of the spleen.

Septic Thrombosis of the Roots of the Portal Vein and of Pylephlebitis is of interest. A paper on this subject has recently been published in American literature by Arpad A. Gerster,³ of New York. This paper will no doubt stimulate pathologists to examine cases that have been operated for peritoneal sepsis traceable to any causes mentioned at the beginning of this chapter for evidence of the infection and thrombosis of the portal vein. Gerster goes very extensively into the literature of peritoneal sepsis in relation to this question. The important points in the diagnosis as emphasized are the following: 1. Presence of precedence of the infection involving the abdominal organs. 2. Presence of pyæmia. 3. Implication of the liver. The prognosis, while stated as being very grave, is not always hopeless, but the only safeguards are early diagnosis and prompt operation.

An intensely interesting paper bearing on the peritonitis caused by the entrance of gastric contents is published by Conrad Brunner.⁴ Brunner brought the gastric contents gained by aspiration from the stomach into the abdominal cavity of guinea-pigs. He found that small quantities of gastric juice with normal percentage of HCl did not kill the rabbits, but if the HCl was absent all of the animals infected

¹ Mortality in Appendicitis; Its Cause and Limitation. Medical News, May 2, 1903.

² La semaine médicale, November, 1902.

³ Reported to the American Surgical Association, in Washington, May 12, 1903. New York Medical Record, June 27, 1903, p. 1005.

⁴ Archiv f. klin. Chir., Band lxxvii. p. 804.

died of peritonitis. These results show that the percentage of HCl in the gastric juice is capable of diminishing the virulence of the microbes causing peritonitis, and therefore the peritonitis occurring from entrance of small quantities of gastric contents into the peritoneum during operations for carcinoma of the stomach must have a high degree of virulence. In perforation from gastric ulcer the gastric contents are much less infectious, varying according to the time that the chyme was exposed to the HCl digestion. In another series of experiments he tested the effect of washing out the peritoneal cavity with normal salt solutions for peritonitis. It was found that infected animals that were washed out in this way lived five days longer than the control animals. The experiments demonstrated that the resistance of the human peritoneum is greater than that of the animals experimented upon.

Peritonitis Treated by Alcohol Applications. Ssaweljew¹ reports two cases of peritonitis treated by external application of alcohol. The first was a case due to perforated gastric ulcer, and the second due to a perforation from appendicitis, and the typical symptoms of perforation from these two causes are given. The alcohol was applied in the following manner: A soft napkin was folded together four times, soaked in alcohol, and when there was no more dripping from it the entire abdomen was covered with it. Parchment paper was covered over the napkin, and the edges of the parchment tucked underneath the napkin on all sides so as to prevent wetting of the clothes of the patient. In the beginning he did not even use the parchment paper, because of the terrible pains, which even the weight of the parchment paper seemed to increase. The applications were made every half-hour, then at longer intervals; finally, only twice in every twenty-four hours. Improvement followed on the second day. Both cases were cured. The author offers several theories in explanation of the action of alcohol; for instance, that by cooling, that by virtue of the hygroscopic action. Some writers claim that alcohol might be absorbed through the skin and act antiseptically upon the peritoneum. Some assume that the alcohol works as a derivative or counterirritant. Finally, the theory of hæmotaxis has been drawn in explanation of this action, on the assumption that the alcohol causes an accumulation of phagocytes and thereby antagonizes the inflammatory process.

Bacteriology of the Fibrinous Exudate in Septic Peritonitis. Thomas J. Lanahan² reports his studies on this subject. In 1897 John M. T. Finney³ advocated that the flakes of partially organized lymph should be thoroughly wiped off of the intestine during lapar-

¹ Alkoholumschläge. Allg. med. Centralblatt-Zeitung, Nos. 12, 13.

² Journal of Medical Research, June, 1903.

³ Johns Hopkins Hospital Bulletin, 1897.

otomies for peritonitis, and asserted that the success of the operation depended upon this method. From the experiments of Lanahan referred to it is to be concluded that in most cases of peritonitis with fibrinous exudation bacteria are present in large numbers in the fibrin. This would justify the removal of the exudate as a safeguard against further infection after the operation.

Peritonitis without Perforation in Typhoid Fever. J. L. Yates'¹ conclusions are :

1. Non-perforative peritonitis usually results from an extension of inflammation through the basis of deep intestinal ulcers, but may also arise from the migration of bacteria through an intestinal wall which is relatively but slightly abnormal.

2. Meteorism predisposes to an infection of the peritoneal cavity, and by decreasing the normal peritoneal absorption furnishes a secondary cause for peritonitis.

3. A hæmatogenous origin of peritonitis is possible in typhoid fever.

4. Non-perforative peritonitis is commonly caused by the typhoid bacillus, and the resulting inflammation is usually diffuse and often severe.

5. The inception of such a peritonitis is clinically indistinguishable from the so-called signs of perforation, and the symptoms in both are due to peritoneal inflammation. The prognosis is probably equally grave in the two forms.

6. There should be appropriate surgical intervention immediately the peritonitis can be recognized.

7. Thrombi, and among them those composed of agglutinated red blood corpuscles, may lead to hemorrhages into the wall of the intestine, and the resulting changes favor the transmigration of bacteria into the peritoneal cavity.

8. Infarction of the spleen may have a similar thrombotic causation, but simple splenic infection is probably not a cause of peritonitis.

9. The specific action upon human blood of an agglutinin generated by the typhoid bacillus can be demonstrated in vitro.

In connection with the purely *medical treatment of peritonitis*, especially that by external applications on the abdomen, it is of interest to present the observations of Prof. Baginski.² Baginski and Prof. Senator presented three children to the Medical Society of Berlin who had suffered from chronic peritonitis and had been cured simply by rubbing soft green soap into the abdominal integument (*Schmierseife*). Baginski warns against hasty surgical interference, and advocates this treatment with green soap. Senator has replaced the green soap by adding to it vaselin and iodoform. The report of such conservative and able clinicians

¹ American Medicine, May 2, 1903.

² Deutsche Praxis, 1902, No. 4.

as Baginski and Senator should cause an investigation into this subject and critical testing as to whether or not such external applications as alcohol, green soap, and iodoform can really bring about a cure of some forms of peritonitis. The first thing to do is to establish that this cure can be accomplished in the manner described. Investigations to solve how will follow afterward. Prof. Comby,¹ of Paris, treats tuberculous peritonitis by rest, fresh air, highly nutritious and digestible diet, and innunction of the abdomen with iodine and green soap. Instead of giving creosote internally, as Comby recommends for peritonitis, Winternitz² urges thyokol, which can accomplish everything that creosote can do, but at the same time it is non-irritating, non-toxic, and odorless. The dose is from 0.5 gm. to 1 gm. (7.5 gr. to 15 gr.) three to four times daily. It has a bitter taste, and should be given in wafers or in form of syrup.

THAT TUBERCULOUS PERITONITIS may heal spontaneously is demonstrated by the observations of O. Borchgrevink,³ who reports the case of a girl, aged sixteen years, who had passed through an attack of pericarditis, from which she recovered very slowly. Shortly after this she developed an abdominal effusion; she was tapped, eleven litres of a yellowish-green fluid being drained off. The effusion reaccumulated rapidly, but later disappeared completely without any special treatment. The tuberculous character of the fluid was demonstrated by inoculation of two guinea-pigs, both of which died of general tuberculosis. Several years after the patient died suddenly after a short illness. The autopsy revealed a tuberculous pleurisy and pericarditis; both of these were probably secondary to a tuberculous lymphatic gland in the neighborhood; there was a typical chronic peritonitis, but at no place in the abdominal cavity could any tubercles be found either by macroscopic or microscopic examination. The only signs of a previous tuberculosis of the peritoneal cavity were the thickened peritoneum and dense adhesions. A few tubercles were found in the tubes and the uterus. This case teaches us that tubercles developing on serous membrane may disappear completely, and that tuberculous peritonitis may heal spontaneously at times and without laparotomy or other operative interference.

It is difficult to conjecture what the result might have been in this case if the other organs had been normal, but it demonstrates the possibility of a cure of tuberculous peritonitis. If there is one deduction justifiable from the literature of the past year on peritonitis it is that the treatment of it is becoming more conservative, and that even leading surgeons are willing to make use of the expectant plan in certain well-defined forms of this disease.

¹ Münchener med. Wochenschrift, 1902, No. 40.

² Deutsche Aerzte Zeitung, 1902, H. 1.

³ Deutsche med. Wochenschrift, January 15, 1903.

ANÆSTHETICS, FRACTURES, DISLOCATIONS, AMPUTATIONS, SURGERY OF THE EX- TREMITIES, AND ORTHOPEDICS.

By JOSEPH C. BLOODGOOD, M.D.

SURGICAL SHOCK.

Blood Pressure.¹ The accurate estimation of the general condition of the surgical patient is of the greatest practical importance. When the surgeon is a careful observer his ability to estimate the various degrees of shock and collapse increases with experience; but the greater his experience, the greater is his desire for an instrument of precision that will accurately inform him of the exact condition of the patient. During the last few years, especially the last year, the literature has been almost crowded with experimental and clinical observations on blood pressure as an index of the general condition of the patient and as one of the symptom-complexes of value in differential diagnosis. The apparatus necessary to record blood pressure during an operation and at the bedside has been simplified. The method of application is easily understood. The knowledge obtained appears to be of great practical importance, and it seems that we are on the eve or already have obtained another instrument of precision the value of which as well as the simplicity of its use may be equal to that of the thermometer.

The general profession are usually slow in adopting new methods in diagnosis, especially if they appear complicated. The estimation and recording of blood pressure has been sufficiently tried to recommend its employment at once by the general profession.

THE BLOOD PRESSURE IN SHOCK OR COLLAPSE. George Crile,² of Cleveland, read before the Boston Medical Library Meeting a most interesting and valuable account of his recent experimental work on this subject. The term "shock" should be used for that condition in which the essential phenomenon is a diminution of the blood pressure, the etiology of which is an exhaustion of this centre of varying degrees due to too frequent or too powerful afferent stimuli. The term collapse

¹ PROGRESSIVE MEDICINE, September, 1903.

² Boston Medical and Surgical Journal, March 5, 1903, vol. cxlviii. p. 247.

should be confined to those cases in which the essential phenomenon is a sudden fall of blood pressure due to hemorrhage, injuries of the vasomotor centre, or cardiac failure. In shock, therefore, we have an exhaustion of the centre, in collapse a suspension of function. Crile, in his experimental work, practically demonstrates that the change in blood pressure in shock is due to afferent impulses acting on the vasomotor centre only; exhaustion of the cardiac muscle, of the cardiac centres, and of the mechanism of the peripheral bloodvessels can be excluded. Therefore, in our treatment of shock, we need bear in mind only the fact that the vasomotor centre is exhausted or overfatigued. In cases, therefore, of pure shock not associated with hemorrhage, drugs which act as a stimulant to the vasomotor centre, the so-called cardiac stimulants, are either inert or harmful. Crile states that there is no justification for the use of alcohol, nitroglycerin, or amyl nitrite. These drugs are of no value as stimulants to the vasomotor centre. Strychnine and digitalis are undoubtedly stimulants of the vasomotor centre, but in shock these centres are fatigued or exhausted, and for this reason these drugs are of little value and may be harmful. Experiments with intravenous saline solution demonstrate that in pure shock it has little effect, and is only harmful when used in large quantities. The problem that Crile attempts to solve is to increase the blood pressure by a drug which will act upon the peripheral vessels, and which will not be harmful to the vasomotor centre, or by mechanical means. From experimental investigation *adrenalin* produces an enormous rise in blood pressure even when the vasomotor centre is exhausted or destroyed. This drug is given in salt solution as a continuous intravenous infusion, the strength of the solution varying from 1:25,000 or 1:100,000. If Crile's experimental investigations are confirmed by clinical observations we shall have in adrenalin-salt infusion a simple, very effective therapeutic measure for the treatment of pure surgical shock. And as surgical shock is so frequently associated with loss of blood, we will have in this combination the two most important therapeutic agents: the adrenalin, which increases blood pressure by its direct action on the peripheral vessels, and salt solution, which supplies the loss of fluid. Crile states that great caution must be exercised in the administration of the adrenalin. As the drug is rapidly oxidized it should be given slowly and continuously, and, according to Crile, intravenously. I am inclined to think that in the clinical application, except in urgent cases, the infusion could be given subcutaneously. This, of course, simplifies the application. We know that in shock the blood accumulates in the veins. Any mechanical means which will prevent this accumulation will increase peripheral resistance and be of great benefit until vasomotor tone is re-established. After

numerous experiments Crile devised a method of supplying artificial peripheral resistance by a rubber suit. The suit is made of a double layer of specially constructed rubber. The suit can be inflated with a bicycle pump, and the amount of pressure varied at will. Crile has already used this pneumatic suit in clinical cases.¹

The conclusions from this experimental work are of great practical value. In collapse cardiac stimulants may be used; in pure shock they are contraindicated. The patient should be placed in an elevated position, head low. All manipulations which would produce painful afferent impulses should be avoided as much as possible. The adrenalin-saline solution should be given slowly and continuously, carefully watching the effect with a blood-pressure apparatus if possible. Peripheral resistance should be increased by tightly bandaging the limbs and abdomen, or by the use of the pneumatic rubber suit. In desperate cases artificial respiration with rhythmic pressure on the thorax should be employed. Although not mentioned by Crile, morphine hypodermically in small doses is of the greatest value. I have frequently observed this clinically, and Cushing's experimental work on blood pressure apparently confirms this clinical observation.

Dr. Crile writes me that he uses Parke, Davis & Co.'s adrenalin chloride. This solution, which comes in small bottles, represents a dilution of one part of adrenalin to one thousand parts of water; for intravenous injection Crile uses a solution varying in strength from 1:25,000 to 1:100,000. He is inclined to think that the best results are obtained from the solution of 1:25,000, and this solution should be given at the rate of $\frac{1}{2}$ c.c. to 1 c.c. per minute. Crile advises extreme caution in its clinical use. The chief danger is the powerful effect of adrenalin on the cardioinhibitory mechanism. So far Crile has thought it best not to give the infusion subcutaneously.

THE ROUTINE DETERMINATION OF BLOOD PRESSURE IN THE OPERATING ROOM AND WARD. Harvey Cushing,² of Baltimore, to whom we owe so much for his recent experimental work on blood pressure, quite naturally is one of the first and most enthusiastic advocates of blood-pressure records as a routine practice in critical operations and in the wards, as an instrument of precision to be used not only in estimating the degrees of shock and collapse, but in differential diagnosis. There is no doubt that the blood-pressure chart during an operation has a distinct value, and I am convinced that this will increase in direct proportion to the number of times that it is used by the operator. Every surgeon feels the need of an instrument of pre-

¹ Crile's pneumatic pressure suit has been placed on the market by the Goodrich Rubber Co., of Akron, Ohio.

² Boston Surgical and Medical Journal, March 5, 1903, vol. cxlviii. p. 250.

cision the accurate records of which will be an index to his operative procedure. It is of the utmost importance to know at every moment during the operation the effect of certain manipulations which, if harmful, could be avoided, and to have an instrument on which one could depend to give warning that the operation and narcosis should at once be discontinued.

Only further experience will demonstrate whether the blood-pressure apparatus is the instrument of precision which will fulfil these requirements.

BLOOD-PRESSURE RECORDS AS AN INDEX TO THERAPEUTIC MEASURES. Recent experimental and clinical observations seem to demonstrate that we have an instrument of precision whose record will allow us to study the effects of, and indications for, both cardiac and vasomotor stimulants and depressants. Cushing¹ speaks of this. Henry W. Cook² has used blood-pressure records extensively in the Thomas Wilson Sanatorium for Sick Children near Baltimore, to regulate the stimulation in children critically ill with summer diarrhoea, and has found that this record prevents overstimulation, indicates when stimulation is required, and the drug which gives the best effect. For immediate effect digitalin is better than strychnine; for prolonged action strychnine seems to be the better drug. The effect of alcohol seems to be rather uncertain. In moderate doses alcohol appears to be a valuable therapeutic agent when there is no urgent demand for a stimulant. It, however, should not be used in large doses. Strychnine and digitalis are much better drugs when a stimulant is urgently indicated. Blood-pressure records demonstrate that salt infusions, though frequently used, gave very indefinite results, and cannot be depended upon for their stimulating effect, and, according to Cook, are contraindicated in sudden collapse. In this condition a hot mustard bath seems to have the best effect. The professional nurse can be trained to keep the blood-pressure chart, and the various therapeutic remedies can be ordered as indicated by the blood-pressure curve. For example: instead of ordering our drugs every two or four hours, we can direct the nurse as follows: when the pressure falls to 80 mm. give strychnine, if to 70 mm. give strychnine and digitalin; if the pressure rises above 105 mm. omit the routine dose of alcohol, if it falls to 60 mm. call the physician. That is, the blood-pressure curve can be used by the nurse as an indication for the use or discontinuance of drugs in a similar way that the temperature chart informs her when to use the cold bath or sponge.

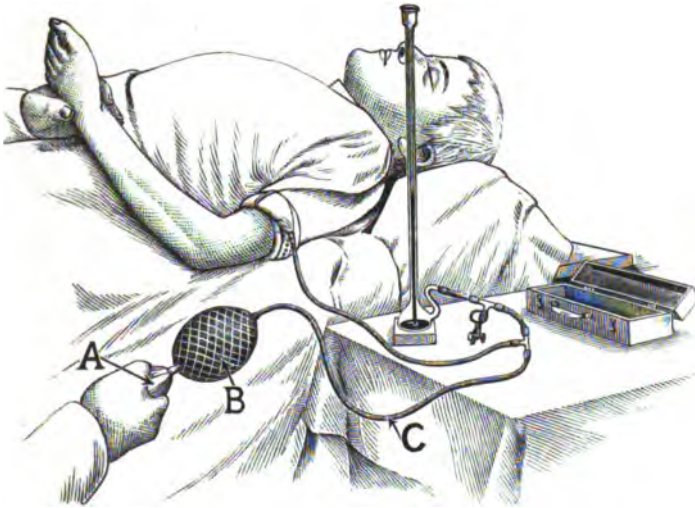
¹ Loc. cit.

² American Journal of the Medical Sciences, March, 1903, vol. cxxv. p. 433, and Johns Hopkins Hospital Bulletin, February, 1903, vol. xiv. p. 37.

John B. Briggs¹ reports his observations in the medical wards of the Johns Hopkins Hospital, which were done in a similar way as those of Cook. Briggs' experience agrees very closely with Cook's.

BLOOD-PRESSURE RECORDS IN DIFFERENTIAL DIAGNOSIS. Harvey Cushing,² from his experimental and clinical observations, demonstrates the great importance of blood-pressure observations in the differential diagnosis of cerebral lesions, especially those of *intracranial hemorrhage*. A detailed consideration of this paper belongs more to the chapter on brain surgery. Other interesting and excellent articles on the subject of blood pressure in diagnosis have recently appeared by Norris,³ of Philadelphia, and Goldwater,⁴ of New York. Crile⁵ has recently found it of value in the diagnosis of typhoid perforation. In his five cases the sudden rise of blood pressure was found to be of the greatest diagnostic value.

FIG. 1.



THE BEST INSTRUMENT FOR THE DETERMINATION OF BLOOD PRESSURE IN GENERAL PRACTICE. In this country experience has demonstrated that the instrument introduced by Riva-Rocci was most satisfactory for routine work. Cook⁶ has modified this apparatus in the direction of simplicity and convenience. This instrument, which is illustrated in Fig. 1, I should advise, and for the details in regard to its use I must refer to the original communication.

¹ Johns Hopkins Hospital Bulletin, February, 1903, vol. xiv. p. 35.

² American Journal of the Medical Sciences, 1903, vol. cxxv. p. 1017.

³ Ibid., p. 888.

⁴ Medical News, May 16, 1903, p. 926.

⁵ Journal of the American Medical Association, May 9, 1903, p. 1292.

⁶ Ibid., May 2, 1903, vol. xl. p. 1199. Johns Hopkins Hospital Bulletin, February, 1903, vol. xiv. p. 37.

These remarks practically open the discussion on blood pressure in this journal, for the reason that the most important work is of recent date. Previous to this I have discussed only the article of Blauel,¹ whose extensive observations on blood pressure during narcosis have been confirmed by more recent work.

Adrenalin as a Vasomotor Stimulant. Miles and Muhlberg² report on experimental work similar to that of Crile,³ and come to the conclusion which is practically identical with Crile's. These investigators have used it subcutaneously as well as intravenously, and, similar to Crile, advise that it be given diluted in normal salt solution. We have also confirming experimental work from Russia in a contribution from P. P. Belaventz.⁴ Therefore, at the present time, all careful experimental investigation seems to demonstrate that adrenalin can be depended upon as a vasomotor and cardiac stimulant of greater value than any other known drug. It should be given diluted in salt solution, subcutaneously or intravenously. However, those who use it clinically should exercise great caution, because in overdose its toxic effects are dangerous and may be fatal. One will find a very interesting discussion on shock, its estimation with a sphygmomanometer, and its treatment with adrenalin and Crile's pneumatic suit in the *Proceedings of the Harvard Medical Society* for March, 1903.⁵ Brewer mentions a case in which the pneumatic suit had been employed clinically with good effect, and another in which he used adrenalin-salt infusion in shock. In this last instance Brewer employed 15 minims of Parke, Davis & Co.'s adrenalin diluted in 1000 c.c. of normal salt solution. The injection was made directly into the vein. The patient was in a critical condition of shock after the partial removal of an exophthalmic goitre. The patient was cyanotic and almost pulseless. The reaction was rapid. After about 500 c.c. had been introduced, the patient complained of precordial pain, and for this reason the infusion was discontinued. Brewer also stated that adrenalin had been used in other cases at the Roosevelt Hospital with satisfactory results. We have, therefore, sufficient experimental and clinical evidence to justify the use of adrenalin-salt infusion in all cases of shock; intravenously if the patient is in a critical condition, subcutaneously in others. In every instance the patient should be watched with the greatest care, if possible with a sphygmomanometer. As the blood pressure rises the drug can be discontinued, to be given again if the pressure falls. Precordial pain apparently is an indication to discontinue the adrenalin.

¹ PROGRESSIVE MEDICINE, December, 1902, p. 80.

² Cleveland Medical Journal, December, 1902.

³ Loc. cit.

⁴ Russki Vratch, February 15, 1903.

⁵ Medical News, June 20, 1903, vol. lxxxii. p. 1195.

Shock Produced by General Anæsthesia. It is of the greatest practical importance for surgeons to understand the degree of shock produced by the various general narcotics. Fenton B. Turck,¹ of Chicago, has again investigated this subject experimentally with the following conclusions: The circulatory disturbances of chloroform and ether are due to their direct action on the vasomotor centre; in both the prolonged effect is vasomotor exhaustion; ether at first is a stimulant, chloroform always a depressant; in addition the toxins of these drugs act directly upon the cells of the body, and this disturbance of metabolism produces toxic products; these products are the cause of the clinical picture following general narcosis with which we are all familiar, and which may be considered a form of autointoxication. This experimental work is in confirmation of that previously discussed, and again emphasizes the fact that general narcotics are contraindicated in shock, and, if they must be used, the time of narcosis and the amount of the narcotic should be limited as much as possible.

THE TREATMENT OF HEMORRHAGE.

We are still searching for remedies and means to check hemorrhage inaccessible to ordinary surgical procedures, for example, hemorrhage from the lungs in tuberculosis, gastric hemorrhages, hemorrhage from the intestines in typhoid fever, uncontrollable bleeding from the various parts of the urinary tract, bleeding in hemophilic patients, and capillary oozing after operation on jaundiced patients.

Intravenous and subcutaneous injections of gelatin are not giving the results which early experiments indicated, and the danger of tetanus must not be forgotten. This danger, which has been previously discussed,² is again emphasized by a contribution of Eigenbrodt.³ For this reason the preparation of the gelatin injection should be carried on with the greatest care and by prolonged fractional sterilization.

Thyroid Extract in Hemorrhage and Hæmophilia. Eugene Fuller⁴ reports two cases in which thyroid extract, given in five-grain doses, three times daily, apparently effected a cure. The first patient, a boy, aged fifteen years, was suffering with constant hæmaturia and swollen joints. After a few doses of thyroid extract the hæmaturia ceased, and in a few weeks the joint symptoms disappeared. The second patient was a man aged fifty-five years. In this case the hemorrhage from the prostate had resisted all ordinary methods until

¹ Journal of the American Medical Association, May 2, 1903, vol. xl.

² PROGRESSIVE MEDICINE, December, 1902, p. 75.

³ Mittheilungen aus den Grenzgebieten der Med. und Chir., 1902, Band x. p. 595.

⁴ Medical News, February 28, 1903.

thyroid extract was given. I find no other references on this subject. Thyroid extract, however, is harmless, and there is no reason why it should not be tried empirically.

Brown,¹ in reviewing Fuller's article, mentions an experience of his own of intractable uterine hemorrhage in which thyroid extract seemed to be the only drug which had any marked effect.

Adrenalin as a Hæmostatic. We have previously discussed the local and general hæmostatic action of suprarenal extract,² of which adrenalin is apparently the active principle. Recent literature seems to indicate that we have in the latter a more certain and less dangerous drug for general and local use. The general action of adrenalin has been just discussed under shock, but it appears to be a drug useful as a hæmostatic on account of its local and general vasoconstrictor action. Lehmann³ has experimented on animals by direct injection of adrenalin into vascular organs, the liver and spleen, and has demonstrated that the part injected becomes anæmic, and after incision or excision there is no capillary hemorrhage, and, so far in his experiments, no tendency to secondary hemorrhage. Lehmann used 1 to 2 c.cm (15 to 30 m.) of a 0.1 per cent. solution of adrenalin. These experiments indicate that this drug may be of practical value in operations on vascular organs to prevent the usual excessive oozing. Bukofzer's⁴ experiments on the mucous membranes of the respiratory tract in man and animals has demonstrated the distinct local constrictor action of this drug as a preventive of hemorrhage during operations and as a treatment for hemorrhage from the mucous membrane. Bukofzer finds that its value is very much less in chronic hyperæmia. This fact should be borne in mind. The drug has been quite extensively used locally as a preventive of hemorrhage in operations on the urinary tract, chiefly urethra and bladder. Prof. A. E. von Fish⁵ recommends the following solution: adrenalin chloride, 0.1; sodium chloride, 0.7; chlore-tone, 0.5; distilled water, 100. This is a solution of about 1:10,000. Previous to operation, to prevent hemorrhage, von Fish injects into the bladder 100 to 150 c.c., leaving it there about four minutes. No bad effects were observed. Gans's⁶ experience corresponds with that of von Fish, but he states that the drug should be used with great caution. Lange⁷ reports a few cases in which adrenalin, applied locally, checked critical hemorrhage after minor operations on hæmophilic patients, and

¹ Maryland Medical Journal, May, 1903, p. 188.

² PROGRESSIVE MEDICINE, December, 1902, p. 69.

³ Centralblatt f. Chirurgie, 1903, Band xxx. p. 464.

⁴ Wiener klin. Wochenschrift, 1902, No. 31.

⁵ Philadelphia Medical Journal, December 13, 1902.

⁷ Münchener med. Wochenschrift, January, 1903.

⁴ Ibid., p. 465.

also a few cases in which he records good results in internal hemorrhage when the drug was given by the mouth. An observation in the experience of my colleague, Dr. Russell, of the gynecological staff, has impressed me with the usefulness of this drug in desperate cases. His patient had been suffering with renal hæmaturia for some months. Secondary anæmia was extreme; her condition was apparently too critical to justify anæsthesia or any operative procedure. Dr. Russell, under local anæsthesia, catheterized the ureters and distended the pelvis of the right kidney, from which the hemorrhage was taking place, with a solution of adrenalin. The hemorrhage ceased at once, the patient recovered, and has been well ever since, a period of over a year. The cause of the hæmaturia was not ascertained.

We need further experience, but undoubtedly we have sufficient to justify its use locally or subcutaneously in salt solution in desperate cases of hemorrhage. Its toxic effects, however, must be borne in mind. In some instances it produces glycosuria (Herter).¹ The toxic effects of this drug are most exhaustively considered in a recent article by Taramasio.²

Steam as a Hæmostatic. The method introduced fifteen years ago by Sneguireff³ has apparently not received the attention which it should in the literature. Koslenko⁴ gives us his recent experience with steam as a hæmostatic and antiseptic. Koslenko has devised a steam saw which checks parenchymatous hemorrhage as it makes the incision. The most complete article on the subject is by L. Pincus,⁵ of Danzig. I trust that I shall have the original monograph to allow a more complete discussion in the next PROGRESSIVE MEDICINE. From the review one is impressed with the value of steam and that the method should be introduced into general surgical practice. It seems the best means to control parenchymatous and other forms of hemorrhage for which, as yet, our methods are crude and unsatisfactory. Steam, when properly used, is also of great antiseptic value for the disinfection of recent wounds and for the treatment of infections. Steam may be used in two ways: *atmocausis*, in which the steam is directly applied to the bleeding or infected part; *zestocausis*, in which it is enclosed in a cylinder and the zone of overheated air about this cylinder is utilized. It was interesting to read in Lauenstein's⁶ article on fractures that he employs *atmocausis* in the treatment of the wounds in compound fractures with apparently excellent results.

¹ American Journal of the Medical Sciences, January, 1903, vol. cxxv. p. 46.

² Revue médicale de la Suisse Romande, 1902, vol. xxii. p. 589.

³ PROGRESSIVE MEDICINE, December, 1902, p. 69.

⁴ Russki Vratsch, January, 1903.

⁵ Review in the Centralblatt f. Chirurgie, 1903, Band xxx. p. 750

⁶ Loc. cit.

Salt Solution Infusion. Recent literature adds nothing except in confirmation of the views already discussed on this most valuable therapeutic measure. I learn from a recent paper of E. Tavel¹ that I have inadvertently misquoted him. In *PROGRESSIVE MEDICINE* for December, 1902, I reviewed Küttner's publication, in which Küttner found that the salt-soda solution of Tavel (0.25 per cent. of sodium carbonate to 0.75 per cent. salt solution) when used subcutaneously was frequently followed by gangrene. Küttner reports six cases. Tavel, however, states, referring to the same communications that Küttner used as his references, that he never advocated this salt-soda solution for subcutaneous or intravenous infusion. Tavel's two communications refer to the value of the addition of sodium carbonate to salt solution as a fluid for the irrigation of fresh and infected wounds, of value because of its physiological alkalinity corresponding to that of the blood, and because of the germicidal properties of sodium carbonate. His work is confirming that of Schimmelbusch that a soda solution kills germs and their spores more certainly and with greater rapidity than plain boiling water or salt solution. Although Küttner, in his publication, does not directly state that Tavel has recommended this solution for infusion, it is, without doubt, from my reading indirectly inferred, and even the title of the article casts an unjustified reflection upon Tavel's clinical and experimental work, which did not deal with this solution for the purpose of infusion.

In addition, there are a number of points in Tavel's article which impress us with the possible dangers in the preparation and use of solutions for subcutaneous and intravenous infusion. Undoubtedly, others besides Küttner used Tavel's salt-soda solution for subcutaneous and intravenous infusions; no doubt deducting from Tavel's reasons that if it was good for the irrigation of wounds, it would be valuable, on account of its alkalinity and germicidal properties, also for an infusion in cases of infection. For this reason Tavel's solution apparently has been generally used in many clinics. In fact, it was introduced in Tavel's own clinic by one of the sister nurses and used for two years without his knowledge, and apparently with no ill effect, until a case of gangrene made him investigate his own solutions. In this case of gangrene Tavel states that the solution was made up rapidly by the nurse and a larger percentage of salt used, but not of sodium, and that the infusion was improperly given. Tavel agrees that the dangers of gangrene after an infusion with a solution containing sodium carbonate are undoubtedly greater because of its irritating properties, but I agree with him when he states that there are other factors besides the presence

¹ *Revue de chirurgie*, 1903, vol. xxvii. p. 437.

of this additional salt; that the danger of sodium carbonate is not very great is demonstrated by its long use in his own and other clinics. Without going into the discussion further, we can be satisfied with the fact that it is better not to add sodium carbonate to salt solution for infusion purposes, that surgeons should supervise the preparation of the solution used for the infusion in their own clinics, and that even a subcutaneous infusion is an operation that should be done with great care. The danger of infection can be avoided by proper sterilization of the solution and the skin of the patient. The percentage of sodium chloride should be not less than 0.6, or more than 0.9. It is still an unsettled question which is the best. A larger percentage of salt is irritating and increases the danger of necrosis. The infusion should be given subcutaneously slowly. Necrosis is frequently induced by the extreme anæmia caused by the rapid or too great infiltration of the tissues; especially is this true when the area infused is not vascular, for example, the buttocks and thigh. The best position for the infusion is in the connective tissue beneath the breast, near the axilla. In my own experience I have never observed infection or necrosis; I have, however, seen one large abscess in which I was quite certain the technique had been faulty. I was informed by the nurse that the surgeon who performed the infusion rubbed the rust off the boiled needle with his unwashed fingers previous to its introduction. I have also seen in consultation four cases of gangrene of a large area of the skin on the posterolateral aspect of the thigh secondary to infusion too rapidly given, also one case of a localized area of necrosis of the female breast in which the infusion had been directly introduced into the mammary gland tissue.

With solutions properly prepared and carefully introduced, subcutaneous infusion is an operation which seldom, if ever, should be followed by any deleterious effects.

The Temperature of the Salt Infusion. R. C. Coffey,¹ of Portland, Oregon, publishes, with illustrations, his apparatus, the object of which is to prevent air bubbles from entering the infusion needle and to estimate the temperature of the solution in the tube, so that this temperature may be maintained at a uniform and proper degree of heat. In my own experience I have not found that such an apparatus is necessary. It is undoubtedly true, as Coffey states, that the fluid as it passes through the tube cools, and it is impossible, without the check of a thermometer in the tube, as well as in the flask, to maintain a uniform temperature; but I am inclined to think that this is not absolutely necessary, although scientifically correct. Infusion is frequently

¹ American Medicine, August 23, 1902, p. 301.

an emergency operation to be performed in all places and under all conditions. For this reason, if possible, we desire a simple apparatus easily obtained. This is answered by the ordinary fountain syringe, which can be boiled quickly. Glass jars are convenient for hospital work, but as they are easily broken they are not as convenient for use in general practice as a rubber fountain syringe.

The stock solution used in Prof. Halsted's clinic is as follows : Sodium chloride, 0.9 ; potassium chloride, 0.03 ; calcium chloride, 0.01 ; distilled water, 99.06. This is prepared by the druggist. The operating-room nurse to prepare the normal salt solution takes 50 c.c. of the stock solution and adds it to 950 c.c. of distilled water. This 1000 c.c. just fills a litre-glass flask, which is corked with cotton and sterilized by the fractional method. We have experienced no ill effects with this solution during a period of about three years.

OPERATIVE TECHNIQUE.

History of Antiseptic Surgery. In a publication of the character of PROGRESSIVE MEDICINE, the object of which is a systematic discussion of the progress of medicine and surgery from year to year, it is not inappropriate to mention from time to time subjects of world-wide historical interest.

The recent Lister Jubilee Number of the *British Medical Journal* (December 13, 1902) affords an opportunity not to be neglected to briefly review Lister's dominant influence in originating and in the development of modern operative technique. Lister's work is almost unique in the history of surgery. In the early development of the various departments of surgery the honors are usually divided. The credit for the initiative and early development of antiseptic surgery belongs to Lister alone.

I shall always feel deeply grateful for the suggestion of Dr. Halsted, when I first became associated with him in 1892, to read from beginning to end the publications of Lister in the London *Lancet*, which began March 16, 1867, and continued up to 1894. Stimulated by this I have from time to time read the contemporaneous publications from different countries on the development of antiseptic surgery. From this pursuit of the literature one is profoundly impressed that Lister's work was the dominant factor in the early years.

The Jubilee Number again corroborates this fact, and for the first time brings together in an interesting and concrete form the life and work of Lord Lister.

Von Bergmann, of Berlin ; von Mikulicz-Radecki, of Breslau ; Lucas-Championnière, of Paris ; Durante, of Rome ; Bloch, of Copenhagen, in

their contributions all mention the fact that they, when young men, visited Glasgow to study Lister's methods. Howard Marsh, Ogston, Cameron, and Watson Cheyne contribute articles of especial historical value, because they were students or assistants of Lister in his early work.

Mr. Lister was thirty-four years of age when he was elected Professor of Surgery at the University of Glasgow. It was a year later before he was appointed one of the surgeons to the General Hospital, and given his first opportunity for clinical observation in his own wards. Surgical technique at this time can be described in a few words. Methods varied with almost each individual surgeon; results, however, were uniform in their disastrous and pathetic consequences; while to-day methods and results are practically uniform. General Sherman's description that war "is hell" would answer for the condition of surgery at the time Lister began his professional career.

Lister's work, previous to his undertaking practical surgery, is a historical confirmation of the present methods of teaching medicine: that scientific laboratory training is the road to success in practical medicine and surgery. This is clearly demonstrated in the titles of the early publications of Mr. Lister from 1853 to 1865. For example: "Observations on the Contractile Tissues of the Iris," "On the Muscular Tissues of the Skin," "On the Flow of Lactile Fluid in the Mesentery of the Mouse," "On the Early Stages of Inflammation," "On the Minute Structure of Involuntary Muscle Fibre," "On Spontaneous Gangrene from Arteritis, and the Causes of Coagulation of the Blood in Diseases of the Bloodvessels," "On the Cutaneous Pigmentary System of the Frog," "On the Function of the Visceral Nerves, with Special Reference to So-called Inhibitory System," "On the Nervous System which Regulates Contractions of the Arteries," "On Coagulation of the Blood," "On the Structure of Nerve Fibres."¹

No surgeon contemporaneous with Lister can show a better list of scientific publications.

Lister's education was unusually thorough. At the age of twenty years, in 1847, he received his B. A. from the University of London. Five years were spent in the study of medicine at the University College in London, and it is interesting to note that the beginning and end of his active medical career is associated with this University and its hospital. After graduation in medicine he was Mr. Erichsen's house surgeon. Two years later he went to Edinburgh and became associated with Prof. Syme. After this association with the two most

¹ For references to these articles see the British Medical Journal, December 13, 1902, p. 1853.

famous English surgeons, he was called to Glasgow to take the chair of Surgery at the University in 1860.

Lister's attitude to surgery at this time can be described as one of intense dissatisfaction with the ordinary methods of the treatment of wounds, while, on the other hand, the majority of surgeons viewed infections and suppurations as inevitable and the natural process of repair. Lister stands almost alone in his enthusiastic study of suppuration and inflammation.

Before he was familiar with the work of Pasteur, Lister taught that the prime cause of suppuration in wounds was the decomposition of blood and serum retained within them, brought about in some way through the influence of the atmosphere. Just at this opportune period Lister became familiar with Pasteur's investigation demonstrating that fermentation and putrefaction depended upon the presence of minute organisms, and that these processes could be prevented when such organisms were excluded. Pasteur's influence on this surgeon is better expressed in Lister's own words, which he addressed to the renowned bacteriologist at his jubilee in Paris, in 1892. Lister said: "Truly, in the whole world there does not exist anyone to whom medical science owes more than to you. Owing to you, surgery has undergone a complete revolution."¹

Lister's discovery cannot be considered an accidental one. He was especially well prepared, not only in a preliminary and medical education, but previous to taking up practical surgery he had devoted much time to physiological and bacteriological work. With the advent of his clinical work in surgery, he at once became dissatisfied with the treatment of wounds and sought for its solution by an enthusiastic investigation to ascertain the causes of suppuration, fermentation, and putrefaction. Fortunately, soon after he became master of a group of surgical wards Pasteur's investigation solved the etiological problem. Armed with this scientific knowledge Lister proceeded with the solution of the problem applied to practical surgery. He had been much influenced by an article on carbolic acid, which demonstrated that even in small amounts it prevented or checked putrefaction and fermentation. He obtained from Dr. Anderson, Professor of Chemistry at the University of Glasgow, some of this acid and determined to use this drug to destroy germs which had already entered wounds and to protect wounds from the entrance of germs by dressings saturated with this acid. This, in a few words, clearly describes the birth of modern surgery. It was not carbolic acid that was discovered, but a system of treatment founded on scientific facts, which led to the development

¹ See remarks of John Cheyne, *British Medical Journal*, December 13, 1902, p. 1848.

of a treatment of wounds, both recent and operative, the results of which practically revolutionized surgery.

Those interested and desirous of further details on this historical subject I must refer to the Jubilee Number of the *British Medical Journal* and Lister's publications in the *Lancet*, which should be read by every young man who wishes to take up surgery as a special branch.

ANÆSTHESIA.

The discussion of this subject was opened in *PROGRESSIVE MEDICINE* for December, 1900. In the next year almost every phase was quite fully considered, and to this discussion I found little to add in December, 1902.

Recently, however, a number of very interesting and important communications have appeared. The most interesting, and, should it prove to be successful, the most important, is the production of general narcosis by the hypodermic injection of a combination of morphine and scopolamine, and the addition of adrenalin to cocaine for local anæsthesia. Nothing important has been added to our knowledge of spinal anæsthesia. The tendency in the selection of a general anæsthetic by those who had formerly used chloroform is toward ether, while the advocates of ether, although they still adhere to ether as the anæsthetic of choice, are beginning to select chloroform in certain cases. Recent communications impress me that mixed narcosis, that is, combinations of ether and chloroform, are yielding results which demand recognition.

The entire subject, therefore, of anæsthesia is receiving unusual attention, and surgeons are becoming convinced that each anæsthetic has its definite indications and contraindications; no one anæsthetic can fulfil all the requirements. The results of men who devote their entire time to giving the anæsthetic are such that every surgeon is beginning to feel that in certain cases the safety of his patients depends not only upon the proper choice of the anæsthetic, but its administration by an expert. The operating surgeon of to-day, therefore, must have associated with him not only skilled assistants and trained nurses, but a skilled anæsthetizer.

Narcosis by the Hypodermic Injection of Combinations of Scopolamine and Morphine. Undoubtedly, the ideal narcosis would be that in which the patient is given a hypodermic injection previous to the operation, before being brought to the operating room, and from which they would awake after their return from the operating table. A drug or combination of drugs which could produce such an ideal narcosis should have dangers undoubtedly less than the anæsthetics in present use. If Schneiderlin's method proves to answer all these

requirements, his name will stand among the greatest in the history of narcosis.

The idea of such a method of narcosis has undoubtedly been considered by many, and there has been considerable experimental work, but with no satisfactory results. The nearest approach to success was that of Dr. Abel, Professor of Pharmacology in the Johns Hopkins University. I remember vividly his experiments with animals some six or seven years ago, but the drug used he considered too dangerous to advocate its employment on human beings. Schneiderlin's first publication appeared in the *Aerztliche Mittheilungen aus und für Baden* in May, 1900. This publication I have been unable to obtain, and there is no review of this article in German or English literature. I became familiar with this subject in looking over my index of recent literature on this subject, and was struck with the only reference to that of Edwin Bloss,¹ the excellent review of which² I had overlooked. Communications by Korff³ are the only references to this subject given by Bloss, besides the original communication by Schneiderlin, who, however, since Bloss' article has given us his further observations in March, 1903.⁴ There is also one from Russia by Heinatz.⁵

The most complete consideration of the subject is found in the communication of Bloss.⁶

Scopolamine belongs to the atropine group of alkaloids. Schneiderlin became familiar with its physiological action because of its wonderful sedative effects in psychiatric patients, and, having used this drug in combination with morphine, he became familiar with a narcotic effect which he proceeded to try for operations. The result of his experimental and clinical experience is confirmed and elaborated in the work of Bloss. Scopolamine and morphine have opposite physiological effects on practically all important organs except the brain. They are both narcotics. Scopolamine dilates the pupil, increases pulse and respiratory rate, increases peristaltic action, raises blood pressure. As compared with atropine and hyoscine, it has apparently no toxic effects in moderate doses. Therefore, these two drugs, scopolamine and morphine, are antagonistic, except in their cumulative hypnotic action on the cerebral centres. The dangerous drug of the combination appears to be morphine, which must be given in large doses. The unsatisfactory feature is the inconstancy in the physiological action with exact

¹ Beiträge zur klin. Chir., 1902, Band xxxv. p. 565.

² Annals of Surgery, January, 1903, vol. xxxvii. p. 149.

³ Münchener med. Wochenschrift, 1901 and 1902. No. 7.

⁴ Ibid., March 3, 1903.

⁵ Russki chir. Archiv, 1902, Heft 6; reviewed in Centralblatt f. Chir., 1903, Band xxx. p. 322.

⁶ Loc. cit.

doses of scopolamine, due, perhaps, to some chemical fault not yet understood in its manufacture, so that one of the problems to be settled in this method of narcosis is the preparation of the pure drug, which shall have a physiological action in direct proportion to exact dosage. Merk's preparation is the best.

When properly employed, and when the dose of each drug does not exceed a certain amount, there is apparently no danger. Schneiderlin records no death in twelve cases, Heinatz in thirty-eight cases, Korff in seven cases. Bloss records one death in 105 narcoses. This patient, however, would have been a critical test for any anæsthetic. The patient was a man aged fifty years, and the operation was an extensive one, with much hemorrhage, for tuberculosis of the pelvis. Examination previous to operation demonstrated emphysema and tuberculosis of the lung, a slight cyanosis due, perhaps, to myocarditis, and a diarrhoea suggesting tuberculosis of the intestine, and some albumin in the urine. The usual preliminary test dose was given the evening previous to operation. This dose is 5 dm. (about $\frac{1}{135}$ grain) scopolamine and 3 cg. (about $\frac{1}{2}$ grain) morphine. It was well borne and produced the necessary effect, indicating that the patient could be narcotized by this method. The next morning a double dose of these two drugs was given—that is, 10 dm. (about $\frac{1}{67.5}$ grain) scopolamine and 6 cg. (almost 1 grain) morphine. Forty-five minutes later a second injection was given of one-half of this latter dose (5 dm. scopolamine + 3 cg. morphine). The narcosis was complete in one-half an hour, pulse 90, respirations 10. After operation the patient was apparently in good condition; he did not regain consciousness; in three hours cyanosis became marked; the patient died six hours after operation from respiratory failure. The autopsy showed, in addition to the lesions mentioned in the clinical diagnosis, extensive amyloid disease of the kidney and liver. Bloss attributes death to the faulty elimination of the drugs.

This represents the only death so far reported, but, unfortunately, there are other unsatisfactory factors. In the first place, the test dose given the evening before may demonstrate that the individual is not a good subject for this narcosis. This was found to be true in six of Bloss' 105 cases. Now and then, after the patient has been given the maximum dose, the narcosis is not sufficiently deep for operative procedure, and for this reason a certain amount of chloroform or ether is necessary. The amount of the general narcotic is always very much less. In twenty-nine of Bloss' cases a certain amount of ether was necessary. In seventy cases the narcosis was ideal in every respect.

The dosage is one of the most difficult problems. The dangerous element is the large dose of morphine. The effect of this drug, of course, is lessened by the antagonistic action of scopolamine, but, as

stated before, the action of this drug cannot be depended upon with absolute certainty.

I should not recommend this method of anaesthesia until we have a further and more convincing report from Schneiderlin and a few surgeons who have adopted his method.

Schneiderlin,¹ in his most recent report, states that he thinks that failures are due to incomplete preliminary tests with the method, to the use of too large dosage, and to not waiting a sufficiently long time between the first injection and the beginning of the operation, at least one and one-half hours. The usual dosage, therefore, is as follows: a test dose of 5 dmgs. ($\frac{1}{130}$ grain) scopolamine and 3 cg. ($\frac{1}{2}$ grain) morphine on the evening before the intended operation; on the morning of the operation 10 dmgs. ($\frac{1}{26}$ grain) scopolamine and 6 cg. (1 grain) morphine; wait one to one and one-half hours; then give 5 dmgs. ($\frac{1}{130}$ grain) scopolamine and 3 cg. ($\frac{1}{2}$ grain) morphine. This is the maximum dose and should never be exceeded even in a healthy individual. In less strong individuals, and in those in which there is myocarditis with poor compensation or any pulmonary lesion, each one of the doses should be decreased, however, retaining the same proportion of scopolamine to morphine.

In the observation of the patient during the narcosis we know that sufficient scopolamine has been given if the pupils are dilated; contracted pupils would indicate an overdose of morphine or a weak action of the scopolamine, and for this a second dose of the latter drug should be given. The respirations should also be carefully watched, and until the patient wakes up there should be a constant attendant, because the tongue is apt to fall back and interfere with respiration. A recent review² incorrectly states that the danger in this method is from arrest of the circulation.

Schickleberger,³ in studying the effects of scopolamine-morphine narcosis in Ewald's clinic, in Vienna, finds that muscle relaxation is not present to a sufficient degree to be satisfactory in many operations, and is inclined to feel that this method will be used as a substitute only when ether and chloroform are distinctly contraindicated. He considers it, however, very valuable when used as preliminary to general narcosis in nervous and restless individuals. A hypodermic injection of about 5 dmgs. ($\frac{1}{130}$ grain) scopolamine and 3 cg. ($\frac{1}{2}$ grain) morphine can be given one hour before narcosis. Wild's⁴ experience with eight cases demonstrates danger. All of his patients were healthy individuals. In seven cases the narcosis had no bad after-effects, although in a few

¹ Loc. cit.

² Journal of the American Medical Association, July 18, 1903, vol. xli. p. 214.

³ Centralblatt f. Chirurgie, 1903, Band xxx. p. 442.

⁴ Ibid., p. 643.

ether or chloroform had to be given in small amounts. In one patient, a healthy girl aged eighteen years, there was no sleep two hours after the maximum dose—15 dmg. ($\frac{1}{3}$ grain) scopolamine and 9 cg. ($1\frac{1}{2}$ grains) morphine. For this reason she was given the usual ether narcosis, from which she did not awake. The respirations became slow and Cheyne-Stokes, the pulse first slow and full, then rapid and weak. It was necessary to give artificial respiration for one hour, to stimulate with camphor, and to give salt infusion. Fortunately, although in a critical condition, the patient recovered.

Ether and Chloroform Narcosis. As a choice between these anæsthetics there is nothing particularly new. Zahradnický¹ has undertaken a statistical study similar to that of Gurlt's published many years ago, and finds among about 30,000 narcoses in various public and private clinics of Bohemia 12 deaths which may be attributed to the anæsthetic, *i. e.*, 1 in 2500. In the majority of cases chloroform of different makes was employed. In this group 10 deaths in about 22,600, *i. e.*, about 1 in every 2260. The remaining 2 deaths were scattered among various pure ether and mixed narcoses. One of the deaths occurred among 1217 ether narcoses, and the second death among 5224 narcoses with Billroth's mixture, which consists of alcohol, ether, and chloroform.

From this statistical study the best results are apparently with the mixed anæsthetic.

Poppert² concerns himself with the experimental study on the effect of the different anæsthetics on the lungs, and concludes that ether vapor more than any other single or mixed drug has the most deleterious effects, but the effect is due to giving ether in too great concentration, which, of course, can be avoided generally in properly produced narcoses. He adds that his clinical and experimental work inclines him to the use of a mixed narcosis, ether and chloroform given with an apparatus which allows exact dosage.

Küttner³ is an advocate of the so-called ether intoxication for short operations, and claims that there is no question that for short or primary anæsthesia ether is the safer anæsthetic. He advises the use of a small dose of morphine a short time before the narcosis. Feilchenfeldt⁴ advises that the patient be given a few days before operation five drops of tincture of strophanthus and five drops of tincture digitalis as a prophylactic cardiac stimulant before chloroform narcosis, especially in patients with signs of myocarditis, and in these cases he advises the use of ether.

¹ Ibid., p. 32.

² Deutsche Zeitschrift f. Chir., 1903, Band lxvii. p. 505.

³ Centralblatt f. Chirurgie, 1903, Band xxx. p. 106.

⁴ Ibid.

Mixed Narcosis. There is little to add on the method of nitrous oxide and ether.¹ It is apparently just as safe as ether, and the post-operative discomforts are undoubtedly less. There is no positive proof yet that lung complications are any less. It is certainly a more difficult method and requires an expensive apparatus. Galloway,² of Chicago, records his satisfactory results with 250 cases in which nitrous oxide was used alone or preliminary to ether or chloroform. Lotheissen,³ of Vienna, advises the use of ethyl chloride preliminary to ether narcosis.

A new method receiving considerable attention is one in which the ether is given in drops on an ordinary chloroform cone as one would give chloroform in the drop method. If the patient cannot be completely narcotized chloroform is added in drops, but the latter drug is used only when the ether drop is not sufficient. Morphine is given preliminarily. Hofmann⁴ and Braun⁵ have had most satisfactory experiences with this method, and claim that by the mixture of the two drugs ether is never given in sufficient concentration to produce lung complications, and chloroform never in sufficient amount to endanger the heart or circulation. Witzel's⁶ experience agrees with this.

Hewitt,⁷ one of the best anæsthetists of London, now advocates a mixture of two parts of chloroform and three parts of ether. Willy Meyer,⁸ of New York, writes a paper strongly in favor of a mixed narcotic called *anesthol*, which is not a mixture, but a chemical combination of ethyl chloride (17 per cent.), chloroform (35.89 per cent.), and ether (47.10 per cent.), while Winckel⁹ has compared the various Schleich mixtures, including the one containing ethyl chloride, with ether, and concludes that they have no advantages over ether.

Ethyl Chloride Narcosis. Lotheissen¹⁰ has carefully considered all the reported cases of death after this anæsthetic, and concludes that there is but one which can be attributed to this drug in 17,000 narcoses. He claims that it is the least dangerous, and the least disagreeable anæsthetic for short operations. I have just been discussing with my colleague, Dr. Warfield, ethyl-bromide narcosis. He has used this drug for a number of years for short operations on the nose and pharynx, especially for the removal of adenoids. He states that it has great advantages over ethyl chloride, in that the patient is anæs-

¹ PROGRESSIVE MEDICINE, December, 1901, p. 136, and December, 1902, p. 80.

² American Medicine, February 14, 1903, p. 263.

³ Centralblatt f. Chirurgie, 1903, Band xxx. p. 522.

⁴ Deutsche Zeitschrift f. Chirurgie, 1902, p. 403.

⁵ Centralblatt f. Chirurgie, 1903, Band xxx. p. 377.

⁶ Münchener med. Wochenschrift, December 2, 1902, No. 48.

⁷ London Lancet, January 10, 1903.

⁸ Journal of the American Medical Association, February 28 and March 7, 1903, vol. xl. pp. 9 and 642.

⁹ Münchener med. Wochenschrift, January 6, 1903.

¹⁰ Loc. cit.

thetized much more quickly. As all these operations are short ones, he never uses the anæsthetic more than four to five minutes, and as the patients come out of the anæsthetic so quickly they are able at once to clear their pharynx of blood. The ethyl bromide comes in flasks sufficient for one administration. The flask is not broken until the moment the patient is ready for the operation. If any of the fluid remains in the flask it is never used a second time, nor for a second patient at the same time, nor is the cloth on the cone ever used a second time, because the ethyl bromide decomposes quickly after exposure to air. Dr. Warfield has had no unpleasant experiences among a few hundred cases. It is undoubtedly a cheaper and more convenient method for short operations in office practice. The cyanosis in nitrous oxide anæsthesia makes it impracticable for these operations.

Conclusions. As our knowledge increases, so does the difficulty of choosing the safest anæsthetic. We are dealing with huge figures. It is always difficult and frequently impossible to be certain that the anæsthetic is the cause of death. As we have previously discussed, post-operative lung complications very frequently follow local anæsthesia as well as general, and are due to emboli from thrombosed vessels in the area of the wound. It is difficult to eliminate the element of shock due to the operative manipulation and the effect of hemorrhage. However, we can state, with almost certainty, that ether and chloroform or the various mixtures, when given properly, have but a small mortality in the healthy individual. The mortality increases with the various pathological lesions of the different organs that the individual to be anæsthetized may have, and it is with these cases that the choice of the anæsthetic is most important. There is no doubt that chloroform is contraindicated in all lesions of the heart muscle, or in any heart lesion with bad compensation. Here ether is the better anæsthetic. Ether is contraindicated in all lesions affecting the respiration, and, perhaps, in marked arteriosclerosis. There is apparently no marked difference between these two drugs on the kidney. In lesions of the kidney both are contraindicated, and if one must use an anæsthetic ether appears to be the one of choice, if there is no lung lesion. In all cases of shock or great debility ether is the safer anæsthetic. The most important factor is to produce the narcosis with the least amount of the anæsthetic. This undoubtedly can only be accomplished by a trained anæsthetist, and I am convinced that we cannot establish absolute rules in regard to the safest method of anæsthesia until we have records in large numbers based upon the results of general narcosis given by experts. In this I agree with Goldan.¹ To the general practitioner

¹ Medical News, August 8, 1903, vol. lxxxiii. p. 286.

who must frequently give an anæsthetic and who cannot be expected to be an expert, I would strongly advise the general use of ether given in as small quantities as possible on an open cone with plenty of air, that is, frequent small amounts of ether rather than large amounts at greater intervals. Chloroform should be used only when ether is distinctly contraindicated, as stated above, and should be given by the drop method.

Death Under Ether Narcosis. There is no doubt, as we have previously discussed,¹ that sudden death during chloroform narcosis is much more commonly observed than with ether. I have mentioned two cases of death under ether narcosis which can be attributed to the very low percentage of hæmoglobin, a contraindication to general anæsthetics that must not be overlooked. I have observed within the last few days a sudden death during a short ether narcosis, the first among about 10,000 ether administrations. The patient was a rather feeble man aged sixty-four years. The examination of the urine and lungs was negative. The area of cardiac dulness was somewhat enlarged, the apex beat diffuse and feeble, the heart sound not well accentuated; there was very slight arteriosclerosis; the patient was admitted to the Johns Hopkins Hospital with a thyroid dislocation of the femur of eighteen days' duration. He was prepared in the following way for anæsthesia. At 9 A.M. he received an eighth of a grain of morphine hypodermically; at 10 A.M. this was repeated. Morphine was given with the hope that an anæsthetic would not be necessary. About twenty minutes later I attempted the reduction without the anæsthesia. The manipulations were too painful, and the muscle spasm too marked to allow reduction. The patient was then narcotized slowly with ether given on an open cone. He passed into narcosis without cyanosis or struggle. The manipulation to complete the reduction occupied about twenty minutes. Just as reduction was about completed, I was informed by the anæsthetist that the patient was getting blue; the pulse was apparently good. He was immediately elevated with the head very low. There was no obstruction to breathing. The cyanosis rapidly increased; the respiration ceased within five minutes. In spite of artificial respiration the pulse became rapidly weaker and stopped within at least ten minutes after the beginning of the cyanosis first observed. The pupils, at first contracted, rapidly dilated. Auscultation of the lung during artificial respiration was negative with regard to accumulation of mucus. An autopsy was refused. For this reason one cannot be absolutely certain whether it was an anæsthetic death or an embolism. I watched the anæsthesia carefully, and there

¹ PROGRESSIVE MEDICINE, 1900, 1901, 1902, December numbers.

can be no criticism in regard to its administration. The first warning was a cyanosis, not associated with any muscle spasm or accumulation of mucus.

Local Anæsthesia. I find but one fact of importance to add to our previous discussion of this method of anæsthesia. The field of its employment will increase with one's experience and the mastering of the finer points in the technique of infiltration and intraneural injections.

Recently adrenalin has been added to cocaine to increase its local anæsthetic effect and to decrease its general toxic effect. The most complete résumé of the subject is by Braun.¹ The effect of adrenalin is to produce a local anæmia on account of its physiological action on small arteries. This anæmia increases the anæsthetic effect of cocaine, and also decreases the rapidity of absorption into the general circulation. For this reason stronger percentages and larger amounts of cocaine can be used. The effect of adrenalin is, therefore, similar to the Esmarch bandage.² Braun recommends Parke, Davis & Co.'s solution of adrenalin, the formula of which is: adrenalin hydrochloride, 0.1; sodium chloride, 0.7; acetone chloreton, 0.5; water, 100. This is, therefore, a 1:1000 solution of adrenalin. The acetone chloreton is an antiseptic, and also a local anæsthetic. The solution as prepared does not decompose and can be sterilized by boiling. It is the same preparation recommended by Crile for intravenous infusion. Braun uses from three to fifteen drops of this 1:1000 solution. The adrenalin solution should be added to the proper cocaine solution and then sterilized. According to Braun, this addition of adrenalin gives the best results when we are using the cocaine solution to infiltrate into or about nerve trunks, and I am inclined to think that it is unnecessary to employ it when we infiltrate the skin, except in cases of inflammation. In this variety of cases cocaine infiltration frequently fails, and if the addition of adrenalin gives the results noted by Braun, it will be a valuable addition to local anæsthesia. The addition of adrenalin seems especially valuable in operations on vascular tissues, for example, amputation of the penis, extraction of teeth, operation on the gums, mucous membranes of the mouth, nose, urethra, and bladder. It has been especially recommended in the excision of angiomas.

Since writing the above I have used adrenalin in cocaine operations about twenty times, with results agreeing with Braun. It is unnecessary for infiltration of the skin, except when inflammation is present, or when we wish to check capillary oozing. Its effects are best seen when we inject about a nerve. For the first time I was able to resect

¹ Archiv f. klin. Chir., 1903, Band lxxix. p. 541. Excellent review, Medical News, May 2, 1903, p. 852.

² See PROGRESSIVE MEDICINE, 1901, p. 146.

a rib 6 cm. (2.1 inches) and open an empyema. Previously, with ordinary cocaine solutions, I had been unable to anaesthetize the periosteum and the intercostal nerve. In this instance the adrenalin-cocaine solution was injected beneath the periosteum and about the nerve. The patient complained of no pain whatever during the stripping back of the periosteum and the resection of the rib.

Dr. McCalla, of Idaho, who just returned from Europe, informs me of the most satisfactory results recently obtained by Mr. Barker, of London, with the addition of adrenalin to eucaine β for local anaesthesia. Barker¹ has just published his results. Barker introduced adrenalin after reading Braun's article. He employs the following solution: eucaine β , 2 grains; sodium chloride, 10 grains; this is added to 100 c.c. of boiling distilled water, after which he adds 1 c.c. of the adrenalin solution.

Reclus,² one of the pioneers in local anaesthesia, records 7000 operations without a death which could be attributed to cocaine. He advises never to use a percentage stronger than one, and always to have the patient in a reclining position. In the discussion one is surprised to learn that a number of French surgeons consider cocaine too dangerous for current use and have abandoned it. My own experience satisfies me that if surgeons will employ weaker solutions, there is absolutely no danger from cocaine infiltration. A 1 per cent. solution is seldom required; in prolonged operations like hernia and removal of goitre, the solution should be at least 1 : 1000.³

Spinal Anaesthesia. I can find nothing in recent literature to change the views already expressed adverse to this method of narcosis.

Tuffier⁴ reports again on his experience with 400 cases with the same enthusiasm. He uses a 2 per cent. solution, and will not admit that any of the fatal cases were due to his method of narcosis. A. W. Morton,⁵ of San Francisco, is the most enthusiastic advocate in this country. Bier is still against its employment, and one sees few articles in its favor.

INFECTIONS.

The etiology of surgical infections is well established as due to bacteria and their toxins. In the treatment of infections there are two problems. The surgical principles in the treatment of (1) the local infection are well established, and, when instituted early, usually effects

¹ London Lancet, July 25, 1903.

² Bull. de l'Acad. de méd., February 3 and 10, 1903.

³ PROGRESSIVE MEDICINE, December, 1901, p. 150.

⁴ Centralblatt f. Chirurgie, 1903, Band xxx. p. 311.

⁵ American Medicine, March 21, 1903, p. 451.

a cure. On the other hand, our means are very limited in the treatment of (2) the general infection.

The problems involved in the treatment of a general infection are those of immunity. This subject is receiving in the laboratory the most extensive consideration. Unfortunately, it is still in its experimental stage, as clearly brought out by two splendid contributions from the leading pathologists in this country. Welch,¹ in his recent Huxley lecture, considers in great detail our present knowledge of immunity, beginning with this statement: "The first place in experimental medicine to-day is occupied by the problems of immunity."

Flexner,² in his oration on the aspects of modern pathology, delivered recently before the Medical and Chirurgical Faculty of Maryland, states that the "corner-stone of modern pathology is toxicology."

Lack of space forbids a discussion of these two papers, but no review, no matter how painstaking, could do justice to the original articles, and as they are accessible to everyone in this country, I urge every surgeon to a careful reading. Although most of the work is yet experimental, and much of it theoretical, nevertheless, the knowledge of this laboratory work on the problems of immunity is indispensable for the surgeon if he wishes to treat local and general infections with any clearness of purpose. We know that, due to the effect of bacteria and their toxins, certain changes take place in the cells and fluids of the body with the production of new bodies which are antagonistic to the toxins of the foreign invaders. When the tissues of the body are attacked they have a certain power of resistance which may be called immunity.

In a few infections laboratory investigations have isolated certain bodies which, when injected into the human or animal organism, act as a positive antidote to the specific toxins of the disease in question. Unfortunately, but very few so-called antitoxins have been isolated. The most perfect is that for diphtheria isolated by Behring. Here even when diphtheritic infection is at its height this antitoxin, as a rule, immunizes the individual and a cure results. The tetanus antitoxin is of value chiefly and perhaps only as a preventive. When the clinical picture of tetanus is well established the antitoxin is of little value, because it cannot reach the toxin now chemically combined with the protoplasm of the nerve cells.³ Although there may be on the market other antitoxins, the contributions of Welch and Flexner establish the fact that for other surgical infections laboratory investigations have not as yet isolated the specific reliable antitoxins. Until this has been

¹ Johns Hopkins Hospital Bulletin, December, 1902, vol. xviii. p. 285.

² American Journal of the Medical Sciences, 1903, vol. cxxvi. p. 202.

³ PROGRESSIVE MEDICINE, December, 1900, p. 126.

accomplished surgeons must seek other means in the treatment of the general infection.

The Treatment of General Infections by Various Intravenous Infusions.¹ From the moment of Pasteur's demonstration that bacteria were the cause of fermentation, putrefaction, and suppuration, Lister applied the principle of treatment with a bactericide chemical substance, carbolic acid. Since this time our chief reliance in combating a local infection has been upon various antiseptic agents. We have, also, learned the great power of the tissues to fight against infections, and that this power can be increased by various local operative interventions, the chief of which is a free incision producing an open wound, preventing tension, and allowing free drainage. From the beginning general infection has been attacked by the administration of antiseptic drugs with the hope that their dissemination through the circulation would have inhibitive or, perhaps, destructive action on the circulating bacteria. The results, however, were never very favorable or conclusive.

Recently this method of combating general infection has been revived and a drug has been administered as an intravenous infusion. Credé, of Dresden, has worked with a soluble solution of silver (*collargol*). Barrows, of New York, has recorded astonishing results with a weak solution of *formalin*. I have had no experience with either. After a careful reading of the recent literature on *collargol* and *formalin*, I must confess that I should not have considered this subject were it not for the astonishing results which have been obtained during the last year at the Union Protestant Hospital of Baltimore, by Dr. Hume, one of the resident surgeons. Hume has treated a number of cases of desperate general infection with intravenous injections of a solution of nitrate of silver in sterile water. Judged clinically, it is very difficult not to come to the conclusion that in some of these cases this infusion only was the agent which saved life. Hume's investigation of his cases has been most thorough, and there is no evidence that the infusion is harmful, and there is every evidence of its value. Of course, we must not expect miracles. Credé is of the opinion that his *collargol* infusion acts only as a bactericide; other German investigators do not agree with Credé, but believe that the soluble silver produces certain changes in the blood cells, or fluids, or both, with the elimination of certain bodies which increase the immunity of the individual. Barrows offers no explanation for his results. Hume's work is the best evidence at hand that his solution does not act as a bactericide agent, but the effect is due, first, to an increase of leucocytes which is always observed in those cases in which

¹ PROGRESSIVE MEDICINE, September, 1903, pp. 83, 367-371.

improvement follows the infusion, and never observed in those cases in which after one or more infusions there is no abatement of the general symptoms of intoxication. Therefore, Hume has demonstrated that the post-operative leucocytosis after the infusion of silver nitrate is an index to its therapeutic value. In addition, Hume is convinced, although not yet able to positively demonstrate it, that the silver nitrate solution increases the production of the various hæmolytic bodies which have powers of immunity. Credé states that he did not observe leucocytosis after his collargol intravenous infusion. Others working with collargol, however, have observed it. In Barrow's cases there are no systematic counts. Hume's investigations, therefore, which will be published shortly, offer the best explanation for the effect of intravenous infusions in general infections.

In the production of immunity we have at least three factors: the leucocytes, first studied by Metchnikoff, at which time he formulated his phagocytic theory of immunity. There is no question that in infections there is a local and general increase in the number of leucocytes. Nuttall, in 1888, was the first to demonstrate the antibacterial properties of the blood serum. Later the work of Behring, Pfeiffer, and especially Ehrlich, demonstrated the importance of the solution of the red blood corpuscle and the formation of certain definite hæmolytic bodies as the chief factor in the production of immunity. Hume is of the opinion that his investigations demonstrate that the action of silver nitrate in the blood is to increase the formation of these antibodies, and that the therapeutic result depends on this action.

Whatever the explanation may be, there is sufficient clinical evidence to justify the intravenous administration of collargol, foramlin, or nitrate of silver in desperate cases of general infection, and surgeons must work along this line until laboratory investigations have isolated the curative antitoxins for the various specific infections.

The entire subject of intravenous therapy is fully considered by Patella.¹ He records the remarkably favorable results in various infections and diseases after the intravenous infusion of various drugs. Patella's conclusions are based chiefly on clinical observations of sublimite in anthrax, carbolic acid in tetanus, cinnamic acid in tuberculosis, and collargol in various infections. In all of his cases Patella records a leucocytosis, to which he attributes the beneficial results. He recommends that the intravenous infusion be repeated until a leucocytosis is produced. Fortesque-Brickdale² gives us the results of

¹ Klin.-therap. Wochenschrift, Vienna, 1903, vol. ix., No. 45. Reviewed in Journal of the American Medical Association, May 2, 1903, p. 1267.

² Lancet, 1903, No. 4141, p. 98. Reviewed in American Journal of the Medical Sciences, 1903, vol. cxxv. p. 1105.

his animal experiments in which he investigated the toxicity of various antiseptics given intravenously and their effect on septicæmia in animals, with the conclusion that he was able to accumulate no evidence that these drugs given intravenously influence favorably the course of a general infection in animals, and in addition, if the drug was pushed beyond the non-toxic dose, it hastened the death of the animal. Here we have the results of animal investigation directly opposite to clinical observation, and, so far in recent literature there are no positive animal investigations to confirm the good results observed clinically in human beings, except those of Beyer,¹ mentioned by von Baracz.² These two investigators worked with collargol. Von Baracz, having observed clinically excellent results in severe anthrax infections after the intravenous injection of collargol, made animal experiments with negative results. He concludes, however, that he might have had positive results if he had used larger and more frequent injections similar to Beyer, who observed positive results in rabbits infected with virulent streptococci cultures. It appears to me that we have sufficient clinical evidence, notwithstanding the lack of laboratory confirmation, to justify intravenous therapy in grave general infections.

INTRAVENOUS INFUSION OF SILVER NITRATE. Thanks to the courtesy of Dr. Hume, I am able to give his method previous to its publication. Hume uses a freshly prepared 10 per cent. solution of nitrate of silver. Of this solution he takes 1 c.c. to 1000 c.c. of sterile water, so that every 100 c.c. of this solution is equivalent to 10 mg. of silver. For an intravenous infusion he gives, according to the gravity of the infection, from 300 to 1200 c.c. (from 30 to 120 mg.) of silver nitrate. The freshly prepared solution should be slightly opalescent, but not opaque. Repetition of the dose is based upon the leucocyte count and the temperature. In a good result the leucocytes fall immediately and then rise, while the temperature should rise immediately and then fall. Clinically, the patient should feel better; especially he has observed that the stupor so frequently present disappears. If this desired result is not observed the infusion should be repeated; however, the absence of this result is usually an indication that the patient is beyond the aid of this method of treatment. When this good result is obtained infusions are repeated only when the temperature begins to rise again and the other symptoms of general intoxication reappear. Hume's best results are those in which only one or two infusions have been necessary. One of his best results was obtained in a case of general streptococcus infection in which the streptococci

¹ Münchener med. Wochenschrift, 1902, No. 8, p. 331.

² Archiv f. klin. Chirurgie, 1903, Band lxx. p. 491.

were found in the blood, another of general typhoid septicæmia in which the typhoid bacillus was found in the blood.

INTRAVENOUS INFUSIONS OF COLLARGOL. More than any other surgeon, Credé has used various silver salt preparations in the treatment of local and general infections. In 1897 he first advocated the intravenous injection of a soluble solution of silver, which he called collargol. This first solution had a number of disadvantages in that it was unstable, and quite frequently there was precipitation of the silver. In his most recent article¹ he informs us that a perfectly satisfactory solution has been obtained by his chemists.² Credé has used this improved collargol since June, 1902, with most satisfactory results. The new collargol comes from the chemists in vials of one-half and one ounce. It is quickly soluble in boiled water. For an intravenous injection Credé advises 4 c.c. to 6 c.c. of a 2 per cent. solution. The fluid should have a clear brown color. One fills an ordinary aspirating syringe, the needle of which is introduced directly into a vein of the arm, and the amount stated injected into the blood. I can find no evidence that this intravenous administration is dangerous. After a very careful reading of the literature on this subject from 1898 up to the present time, there is enough evidence to justify its trial. Credé, undoubtedly similar to Tuffier with spinal anæsthesia, is an enthusiast in regard to the use of silver salts, and I am inclined to think that he exaggerates its value. The observations of others, however, are sufficient to justify its use. It is unnecessary to give here the voluminous references, the most recent of which is that of von Baracz.³ In recent literature the French references far outnumber those of the German, and of the former Netter⁴ is a most enthusiastic advocate.

INTRAVENOUS INFUSIONS OF SALT SOLUTION IN INFECTIONS. There is no doubt as to the efficacy of this therapeutic agent, and recent literature on this subject confirms our previous remarks.⁵

The Effect of Alcohol in Infectious Diseases. This, undoubtedly, is an important question. I am inclined to think that the majority of physicians and surgeons administer alcohol in large and repeated doses to patients critically ill with various infectious diseases and general infections. Hare,⁶ from an experimental investigation, concludes that alcohol seems to increase the power of the blood, to produce immune bodies, especially the complement. Klemm,⁷ after review of clinical

¹ Archiv f. klin. Chirurgie, 1903, Band lxix. p. 225.

² The agents for this country are Schering & Glatz, 58 Maiden Lane, New York.

³ Loc. cit.

⁴ Centralblatt f. Chirurgie, 1903, Band xxx. p. 500.

⁵ PROGRESSIVE MEDICINE, December, 1900, p. 107, and December, 1902, p. 73.

⁶ Therapeutic Gazette, May 15, 1903.

⁷ Archiv f. gesammte Physiologie, 1903, Nos. 7 and 8.

and experimental data, concludes that the use of alcohol in large doses is justifiable. Meltzer,¹ in discussing his own experience and that of the literature, states: "Alcohol in health is often a curse, alcohol in disease is mostly a blessing." Goldberg,² from a series of animal experiments, demonstrates that the previous administration of alcohol to dogs, naturally immune against anthrax, destroys this immunity. These experiments apparently demonstrate that the chronic alcoholic individual is less resistant to infections, but does not prove that alcohol is harmful when administered in a non-alcoholic patient. My personal experience with alcohol in grave surgical infections is against its routine administration in large doses.

Richard C. Cabot,³ of Boston, contributes the most interesting article in regard to the action of alcohol in disease. His conclusions demonstrate that alcohol in therapeutic doses has no effect whatever upon the blood pressure. Alcohol is inert in relation to temperature, pulse, respiration, appetite, sleep, delirium, and secretion. "As a narcotic and vasodilator it may have an important place in therapeutics." The most important question, however, according to Cabot, is the effect of alcohol on the power of the blood to produce immune bodies in infection. This problem, however, is still unsettled.

FRACTURES.

A comparison of the recent literature on fractures from different countries impresses one with the fact that this important branch of general surgery is given perhaps the least consideration in American literature. Surgeons in this country confine their contributions much more to abdominal surgery, while fractures and the great field of surgery of bones and joints is, to a certain extent, neglected. This appears to me unfortunate, and I am quite convinced that there is much neglected material in many if not all of the large surgical clinics in this country. Without doubt X-ray studies are made, and in the majority of instances the cases are properly diagnosed and treated, but the experience of these clinics, especially studies of a large series of cases of fractures and the different diseases of bones and joints, is not published for the benefit of the general profession. For this reason, in the review of the recent literature on fractures, one is compelled to use German literature almost exclusively in the discussion. Fortunately, these German contributions deserve the greatest praise. The article is written by one of the

¹ American Medicine, July 12, 1902, vol. iv. p. 60.

² Centralblatt f. Bacteriologie und Parasitenkunde, 1901, Band xxx. pp. 696 and 731.

³ Medical News, July 25, 1903, p. 145.

younger men connected with the largest surgical clinics in Germany, so that in each instance we are given a large series of cases. The X-ray studies are complete, the comparative discussion of the literature most satisfactory.

One is at once convinced that advance is being made in the diagnosis and treatment of fractures. To present this, however, in a few words is difficult. The chief factor in this progress is Roentgen radiography.

The progress is chiefly due to the better knowledge of the pathological anatomy of the fracture pictured in the Roentgen plate. In addition, we are beginning to obtain definite clinical pictures associated with fractures previously seldom, if ever, recognized before the use of the X-ray. Fractures formerly considered rare are now found to be not uncommon.

The diagnosis of fractures from an X-ray negative is comparatively simple in the majority of instances. The relation of the radiograph to the clinical diagnosis of a fracture is the same as that of the microscope to the clinical diagnosis of tumors and other pathological conditions. As our experience increases in the observations and careful record of clinical pictures in which the diagnosis is confirmed by the X-ray, by operative intervention, and by the microscope, our knowledge to make the diagnosis without these aids also increases, and for this reason, in the study of fractures, it is of the greatest importance not to neglect the careful study of the clinical picture, so that, as frequently occurs, we may be able to make an equally certain diagnosis when the use of the X-ray is inconvenient or impossible.

In some instances, however, the interpretation of the X-ray is unusually difficult. The shadow cast by fractures of the bony diaphysis is simplicity itself to interpret, also that of the epiphysis after complete ossification, while the reverse is true of the shadow of the epiphysis before complete ossification. Fortunately, recent extensive X-ray investigations of the epiphysis at different ages have increased our knowledge, and demonstrate that one must be familiar with the changing normal Roentgen shadow of the epiphyses in order to properly interpret fractures of this area. I will discuss these in considering the fractures at the different epiphyses.

The Treatment of Fractures. There is no doubt that recent experience is making radical changes in the older methods of treatment, chiefly in the substitution for the older immobilizing dressing one which allows better circulation, more joint motion, and produces less muscle compression. In addition, dressings are more frequently changed, in order that we may inspect the seat of fracture and to allow passive motion of the neighboring joints with massage of the muscles.

In the ideal result muscle tone and joint function should be, in the majority of instances, as perfect when bone union is complete as they were previous to the fracture. When a fracture is immobilized and the splint only changed a few times during the entire treatment, the loss of muscle tone, muscle atrophy, and joint restriction increase with the age of the patient and the approach of the fracture to the joint. When circular compression is marked and prolonged interstitial anæmic myositis is the rule, perfect recovery from this pathological condition seldom takes place.

We may summarize the treatment of fractures as follows: Reduction of the deformity as perfectly as possible; when this fails under narcosis, operation with fixation of the fragments. Retention of the fracture in its corrected position with as simple a dressing as possible; a dressing which allows joint motion, which does not constrict muscles, and one in which the patient can walk after the first few days without danger of dislocating the fragments. Quite frequent change of dressings to allow inspection of the fracture, passive motion and massage. The immobilizing features of this dressing must be increased in direct proportion to the tendency of the fragments to change their position after proper reduction, and in those cases in which immobilization is indicated this feature can be decreased as bony union becomes manifest. In general, the treatment of the various fractures varies from one in which no dressing at all is necessary to one which must be completely immobilized. For this reason the discussion of the treatment of fractures is presented more clearly in connection with the consideration of the special fracture. The general principles apply, however, to every fracture, but the form of dressing differs to a certain extent with each fracture, and this variation in the dressing is due entirely to the tendency of the special fracture to displacement. As this tendency to displacement increases we are compelled to neglect the better treatment of the muscles and joints.

The most comprehensive discussion on the general treatment of fractures has recently appeared by Nicolai Wolkowitsch,¹ of the Alexander Hospital, in Kieff (Russia). I shall make extensive use of this article in the discussion of the treatment of special fractures.

Borchard,² of Posen (Prussia), bases his treatment of fractures on the pathology of the injury. The first swelling about the fracture is due to blood extravasation, which is soon increased by an exudate of serum.

The granulation tissue between the fractured ends is soft, and there

¹ Deutsche Zeitschrift f. Chirurgie, 1902, Band lxxiii. p. 203.

² Centralblatt f. Chirurgie, 1903, Band xxx. p. 129.

is no ossification up to the tenth to fourteenth day; bony union is usually quite firm by the twenty-fourth to twenty-eighth day. For this reason, Borchard, in the majority of instances of fracture, makes no forcible attempt at correction for ten or twelve days, but during this time, in fractures of the upper and lower arm and leg, he places the injured part in temporary splints. Gentle massage is begun within twenty-four hours and is gradually increased. On the third or fourth day slight passive motion is made in the neighboring joints. The result of this treatment is the rapid absorption of the exudate and all the swelling, except that due to the formation of callus. On the twelfth day, if the fragments are not in good position, they are reduced under narcosis, which is quite possible on account of the soft callus, and the limb is immobilized in a plaster dressing. This dressing is left in place until about the twenty-sixth day. At this time the bony union should be pretty solid. Now the plaster dressing is cut down to allow a daily temporary removal for passive motion and massage, and if the fracture is situated in the leg the patient is allowed to get up and walk. My own experience and that of recent literature agrees with Borchard as to the importance of early massage, but not in the delay of the reduction of the fracture. In some cases this reduction should be done under narcosis at once, in others a delay of two or three days is not harmful, but to delay ten or twelve days is unnecessary, and in many cases harmful, because if there is overlapping of the fragments the contraction of the muscles, which will certainly take place, will make reduction more difficult, perhaps impossible, in spite of massage at this later date. As clearly demonstrated by Wolkowitsch it is quite possible, after the immediate reduction of the deformity, to apply a dressing which will allow a certain amount of motion and massage in the early days. In addition, I am quite convinced that experience will demonstrate that the immobilization as practised by Borchard, between the twelfth and twenty-sixth day, will be associated with a certain amount of deleterious effects on the muscles and joint, and much of the good accomplished by his early massage will be lost by his later immobilization. The importance of as early massage and passive motion as possible cannot be denied, but these manipulations should be uniform throughout the entire treatment of fractures. In the early days it should be more frequent, because at each séance, on account of the tenderness and danger of displacement, both manipulations must be restricted in time and degree; later, as the callus becomes more firm, the interval of time can be increased as each treatment becomes more energetic.

The modern method of treatment of fracture unquestionably takes more time and personal supervision than the older methods, as Lucas-

Championnière,¹ surgeon to the Hôtel Dieu in Paris, and its greatest advocate, admits.

As one's experience with and reading of this method of treatment increases, one quickly learns what variety of fractures justify by their better results this great increase of time and personal attention, and others in which it is not necessary.

The Operative Treatment of Fractures. The views expressed in *PROGRESSIVE MEDICINE* (December, 1902, p. 94) are confirmed by my recent experience and reading. There is yet, however, a great diversity of opinion, best shown in the discussion on this subject in the Thirty-first German Congress.² Völcker, of Heidelberg, considers that the indications for primary suture in fresh simple fractures are limited. His experience demonstrates that it is followed by delayed union, and that the dangers of infection when the fracture is situated deep and is surrounded by muscle must be borne in mind. Operation is only indicated in those complicated fractures, especially near the joint, in which reposition or retention of the fragments is very difficult or impossible. W. Arbuthnot Lane,³ of London, however, is an advocate of the operative treatment, and states that his investigations demonstrate that complete reposition of the dislocated fragments in many fractures is only possible by operative intervention. Fritz König, on the other hand, claims that exact apposition is not of supreme importance for good function in fractures of the shaft, but in fractures near the joint absolute apposition is of greatest importance, and, in addition, this perfect approximation is associated with less callus formation; both these factors improve joint function. Trendelenburg, of Leipzig, agrees with König; Körte, of Berlin, restricts his operative intervention similarly to Völcker. Henle, of Breslau (v. Mikulicz's clinic), calls attention to the defective union after suture of the diaphysis and the better results in suture of fractures of the epiphysis. Lauenstein, of Hamburg, and Schlange, of Hanover, also call attention to delayed union after operation and suture. The results of Guthrie,⁴ of Wilkesbarre, Pa., in the direct fixation of recent simple fractures are unusually satisfactory, and his experience is fortunately large. Guthrie also states that he does not hesitate to operate at the homes of his patients. Here he has been able to get as satisfactory technique as in the hospital. He advises the use of rubber gloves.

My own experience in the immediate operation of fresh simple

¹ *Traitement des fractures par le massage et la mobilisation*, 1895.

² *Centralblatt f. Chirurgie*, Band xxix., June 28, 1902, pp. 47-55. See also editorial in *Annals of Surgery*, 1902, vol. xxxvi. p. 974.

³ See also the *Practitioner*, London, March, 1903.

⁴ *American Medicine*, March 7, 1903, vol. v. p. 376.

fractures is limited. So far, in all of the operative cases, I have not observed any delayed union mentioned by other surgeons. In a few cases in which the approximation was very accurate and in which the spiral character gave a large bony surface for union, ossification was unusually early (three weeks). I have, fortunately, experienced no bad results in the healing of the wound. For this reason, if an operation is indicated, I am not influenced against the procedure by the fear of delayed union or infection. The great majority of simple fractures, however, can be treated without operation when one uses narcosis for reduction. It is this fact that makes one hesitate to operate without definite indications. On the other hand there are certain fractures in which, without operation, we can be as positive of a bad result as we are of the good result in the larger group already discussed. It is to this group of fractures that the surgeon should give his special attention. On the whole, I am inclined to feel that this group will grow larger as we study our cases more carefully in the fresh with the X-ray, and as we follow the ultimate result in cases not operated on. In addition, there is a middle group in which as yet it is difficult to demonstrate whether an operation is indicated or not, but I should advise one who is in doubt and who can command proper technique to choose the more certain result of operation than the doubtful result of conservative treatment. It is to be borne in mind that the narcosis for the operation will be a longer one than that for simple reduction, but I do not think that the dangers or discomforts of the longer narcosis are sufficient to weigh against operative intervention. Experience has also taught us that the fractures in which operations are indicated are also the most difficult to reduce even after the free exposure of the fragments. So that the surgeon who has not had experience must be impressed by the fact that many of these operations are by no means simple affairs, and should not be undertaken except by one who has sufficient surgical training to justify the performance of an operation which is not absolutely necessary. To the general practitioner I would advise that they school themselves to recognize clinically or with the X-ray the smaller group of fractures in which operation is or may be indicated to ensure a more perfect ultimate result, and, if they are not operating surgeons, to seek consultation in these cases within the first five or six days after the injury, in which, if operation is indicated, better results are obtained than later.

Special Fractures. In the modern treatment of fractures of different varieties I shall attempt to point out the cases in which operation is indicated, and the dressing best adapted for fixation.

FRACTURES OF THE UPPER END OF THE HUMERUS. Operation is indicated only when the smaller fragment is dislocated and cannot be

reduced. This takes place most frequently in epiphyseal separation. As a rule, this can be recognized clinically and always with the X-ray. The operation, if performed within the first ten days, will usually allow proper reduction. Later, when united with deformity, resection of the smaller fragment will be necessary. In the majority of cases, however, the tendency to displacement is not great, and the fragments can be brought into perfect apposition by simple extension. Wolkowitsch¹ writes that in fractures of the anatomical head he reduces the fracture by simple extension, and then places the arm in a sling, using no retentive dressing whatever; he then institutes early massage and passive motion. I should not advise this, but agree with Helferich, that extension is the most important factor in the treatment. This extension can be easily maintained, whether the patient is in bed at night or up during the day. A simple retentive dressing holding the arm to the side with a pad between the arm and the chest should be used. In older people this should be changed daily to allow massage and passive motion. Permanent fixation of these fractures, especially in the old, is usually followed by more or less restriction of motion in the shoulder-joint. In Scudder's recent *Text-book on Fractures*² extension is not recommended; the dressing applied produces unnecessary immobilization; passive motion and massage are not recommended until the second week. Even if there is a tendency for displacement of the fragments, this immobilization is not necessary if extension is used, and in older people, at least, passive motion and massage should be begun in the first few days.

Fig. 13 in PROGRESSIVE MEDICINE, December, 1902, p. 103, illustrates how simply extension may be obtained; at night this can be attached to a pulley.

SPIRAL FRACTURES OF THE SHAFT OF THE HUMERUS. In the majority of fractures of the shaft of the humerus operation is not indicated, reduction is not difficult. As a rule, a very simple dressing will hold the fragments in place. This dressing need not be snug. For this reason frequent changes in the dressing are not necessary, and, as the fracture is some distance from the joint, passive motion of the elbow and shoulder need not be made, except at infrequent intervals. I prefer the dressing illustrated by Scudder. I have found that the primary bandage on the forearm is unnecessary. After reduction of the fragments the arm is held in abduction and extension, forearm flexed. The arm is then fixed in well-padded approximation splints, then allowed to rest snugly on a triangular axillary pad well shown in Fig. 2. Afterward the arm is fixed to the body by a circular

¹ Loc. cit.

² Atlas and Epitome of Traumatic Fractures and Dislocations. Philadelphia, 1902.

roller including the chest. If the splints about the arm are not fixed too tightly, there will be no swelling of the forearm. The forearm, which hangs in the sling, can be moved gently by the patient, and gentle massage can be given by a member of the family or by a nurse. Every few days the surgeon can remove the circular bandage holding the arm to the chest, and give passive motion at the shoulder, at the same time removing the axillary pad to allow bathing the skin with alcohol and dusting it with a toilet powder. It is not necessary to remove the fixation splint on the arm more than once a week. The weight of the arm, as a rule, is sufficient extension. If, however, the

FIG. 2.



Fracture of the shaft of the humerus. Note bandage to hand, forearm, and elbow; axillary pad and strap; coaptation splints and sling. Bandage does not cover fracture. (SCUDDER.)

fracture is oblique, and there is a tendency to shortening, further extension can be accomplished by fixing a weight to the flexed forearm, using a wide bandage.

Spiral fractures of the shaft of the humerus are not uncommon. Their number increases when we take an X-ray photograph of the shaft. It is difficult and, in the majority of cases, impossible to make the diagnosis clinically. These spiral fractures must be recognized, because they are more difficult to reduce and, when properly reduced, extremely difficult to retain in proper position for bony union. Lane¹

¹ Loc. cit.

advocates incision and wiring in all cases. I am not positive that this is always necessary. Our knowledge of spiral fractures has recently been increased by contributions of Oscar Wolff,¹ Zuppinger,² Lauenstein,³ Dietzer.⁴ These surgeons confined their investigations chiefly to spiral fractures of the lower extremity, but mention the possibility in the humerus. I will discuss their articles under "Spiral Fractures of the Lower Extremity."

A recent observation of my own illustrates the clinical picture and treatment of a complicated spiral fracture of the shaft of the humerus better than any that have appeared in the literature. The patient, a physician, about thirty-three years of age, fell as he was attempting to get in his buggy, which was moving slowly. There was very little room between the wheels and edge of the road, which dropped suddenly a few feet. He slipped on this edge and fell to the ground. The rear wheel of the buggy passed over the arm just above the elbow. From his description of the accident I am inclined to the opinion that the arm rested on the elbow, so that when the wheel passed over the arm the humerus was bent and at the same time twisted, and we had two forces acting: a bending and a torsion with fixation at the elbow, and, perhaps, additional torsion due to a forced movement of the body at the shoulder-joint. There was very little pain or discomfort.

Examination ten hours after the accident. The patient was sitting with the forearm flexed and the arm hanging at the side of the body extended, there was no apparent deformity, and not more than 5 mm. shortening. There was a good deal of swelling from the middle of the arm extending beyond the bend of the elbow. In places the discoloration of blood could be seen beneath the skin. On palpation there was but slight crepitus, and over the external lateral surface, at about the junction of the middle and lower third of the arm, one could feel a loose fragment. Motion in the lower third of the arm was extensive. In the absence of very distinct crepitus, the large degree of motion, the extensive area of local tenderness, and blood extravasation indicated that we were dealing with an oblique, probably comminuted fracture. These clinical points, I found later, agreed with the observations of Zuppinger and Lauenstein.⁵ The dressing just recommended for fractures of the shaft of the humerus was applied (without the primary roller of the forearm). I saw the patient again six days after the accident. He lived in the country and I advised him to come to Baltimore for an X-ray examination, because I felt that we were dealing

¹ *Centralblatt f. Chirurgie*, 1901, Band xxviii. p. 123.

² *Beiträge zur klin. Chirurgie*, 1900, Band xxvii. p. 735.

³ *Deutsche Zeitschrift f. Chirurgie*, 1903, Band lxvii. p. 455.

⁴ *Ibid.*, 1901, Band lxi. p. 260.

⁵ *Loc. cit.*

with a complicated fracture in which operation might be indicated. During this time he suffered no discomfort, and was able to give his forearm massage and the elbow passive motion. Plate I., Fig. 1, shows the spiral fracture of the lower third of the humerus with one long, thin, loose, fragment. The slight overlapping of the two main fragments is seen (*dislocatio ad longitudinem*), and a considerable dislocation of the loose fragment (*dislocatio ad latus*). After taking this X-ray the original dressing was removed, and, after considerable extension and manipulation, a similar dressing was applied. Plate I., Fig. 2, was taken immediately after this second dressing was finished, and demonstrates that the attempts at the reposition of the fragments had completely failed, except in overcoming a little of the longitudinal displacement. Unfortunately, it did not occur to me at this time to place the arm in an extended and abducted position on a Middeldorpf triangular splint.¹ I was chagrined, because only a few months previously I had described this splint for this variety of fracture in *PROGRESSIVE MEDICINE*. Demonstrating that I could not completely approximate the fragments, operative interference was advised. It occurred to me that the fragments were, perhaps, separated by a torn piece of muscle. This was quite possible in view of the severity and direct force of the injury. At the operation the fracture was exposed by separating the outer head of the triceps from the brachialis anticus muscle. This incision exposed the loose fragment and the lower fragment. Between the fractured surfaces there was blood, but no muscle. This loose fragment was intimately attached to the triceps muscle. Nothing was done toward separation. The lower fragment and the loose piece of bone were wired. The muscular spiral nerve encircled the fracture at about the centre. In order to prevent this nerve from being caught in the subsequent callus, the triceps muscle was separated a little, the nerve pushed into this groove and held in place with catgut sutures. The upper portion of the fracture was then exposed through a second separation of the triceps muscle. It was now demonstrated that any attempt at wiring the upper part endangered by the necessary manipulation the muscular spiral nerve. For this reason only the single wire was used. I found, however, that if I placed the arm in extreme abduction and extension the three fragments snugly approximated each other, perfectly restoring the continuity of the humerus; when, however, I brought the arm in extension to the side of the body, the fragments again separated. Here we had a positive demonstration that the abduction position was a proper one for this fracture. It is to be noted that in the operative manipulations the periosteum was not

¹ *PROGRESSIVE MEDICINE*, December, 1902, p. 103.

separated from any of the fragments. For the first week after the operation the patient was kept in bed, flat on the back, with the arm held by extension in extreme abduction. Then the arm was fixed in Middeldorpf's triangle, and the patient allowed to get up and walk. The dressing was changed three days later, and then not again for nine days. At this last dressing, exactly twenty days after the operation, union was so firm that Middeldorpf's triangle was discontinued, and the arm was fixed to the body with a simple dressing and the forearm held in a sling. At the end of the fourth week all the dressing was discontinued except the sling to the forearm. During these four weeks the patient was given thyroid extract, five grains three times a day. It is to be noted that there were no signs of injury to the musculospiral nerve. Plate I., Fig. 3, is an X-ray four weeks after the operation. The approximation of the fragments is almost perfect. The shadow of the callus is almost as dark as that of the old bone. The silver suture is seen in the lower part. The result is practically perfect.

MIDDELDORPF'S TRIANGLE. My personal experience with this apparatus has convinced me of its great usefulness in spiral and oblique fractures of the shaft of the humerus, and I am inclined to feel that in the case just reported the result with this method of dressing would have been equally satisfactory without operation. The demonstration during the operation of the effect of abduction on position of the fragments is almost conclusive. The application of the dressing is simple. I made a triangle by bending a long piece of wire splint and fitting it on the uninjured arm; each side of the wire triangle was strengthened by a thin piece of board splint, fixed to the wire with adhesive straps. The injured arm was then held in abduction fully extended. The arm between elbow and shoulder was fixed in a dressing with narrow approximation splints. The triangle was then placed between the arm and the body well padded. The arm was first bandaged with a simple roller to its side of the triangle, then the body. Now, by increasing the padding between the forearm and its side of the triangle, extension was made on the fracture, then the forearm was bandaged. Morning and evening the bandage about the forearm was removed to allow passive motion at the elbow and massage. Daily, or every other day, the bandage about the body was removed to allow slight passive motion at the shoulder. At each change of dressing the padding between the splint and the body and that beneath the forearm was changed in order to keep up extension. It cannot be said that this is a very comfortable dressing, but it allows the patient to walk, but slight change in the dressing is necessary for passive motion and massage, and, most impor-

¹ PROGRESSIVE MEDICINE, December, 1902, p. 103.

tant, the two chief factors in the treatment of this form of fracture, abduction and extension, are maintained by the simplest ambulatory apparatus.

Wolkowitsch¹ advises Middeldorpf's triangle, not only in fractures of the shaft, but in the upper epiphysis. His apparatus is shown in Fig. 3. The triangle is made of plaster of Paris.

WOLKOWITSCH'S METHOD OF MAKING PLASTER-OF-PARIS AMBULATORY SPLINTS. This plaster-of-Paris splint is prepared in a soft condition, the limb is then held in the proper position, the soft splint applied and allowed to harden. The scaffold of the splint is made of pasteboard, which is cut in the proper length and width. This paste-

FIG. 3.



FIG. 4.



board is then covered with a wet plaster bandage. The first turn is usually in a longitudinal direction four or five turns, then spiral turns until the plaster is covered with ten to twelve layers. The plaster bandage should be softened in very hot water; the splint must be rapidly prepared. Previously to applying the soft plaster splint the parts are covered with a soft bandage, best a flannel bandage. These splints are easily prepared, their application is not difficult, and, as they do not encircle the limb, they allow a certain amount of motion at the joint and do not constrict muscle. In the majority of instances the immobilization is sufficient, but never as perfect as a complete plaster bandage. These splints allow better inspection of the fracture;

¹ Loc. cit.

they are more easily removed and replaced than a complete plaster cast. Fig. 4 is a dressing used by Wolkowitsch for fractures of the lower end of the humerus with tendency to posterior dislocation. The illustration shows that the long, oblong splint is moulded to the posterior and external lateral surface of the arm and forearm, extending from the shoulder to the wrist.

Fractures in the Neighborhood of the Elbow-joint. I have little to add to what has previously been said on this very important variety of fractures.¹ A comprehensive knowledge of the Roentgen shadow of the elbow at various ages before complete ossification is of the utmost importance in the diagnosis of these fractures. Perfect reduction of the fragments, which is necessary for a good result, is usually difficult. As previously discussed, there is a great difference in opinion with regard to methods of treatment. There are many advocates of full extension (Bardenheuer, Wolff, and others), while others prefer fixation with the forearm from a position of right-angle flexion to complete flexion, according to the variety of fracture. Extension methods are very difficult in their application; many necessitate keeping the patient in bed, and I am unable to convince myself that the results are any better. Fixation after perfect reduction with the forearm flexed at a right angle or completely flexed, according to the variety of fracture, commends itself, because of its simplicity and equally good results. As the majority of these fractures are associated with injuries of the joint or direct involvement of the joint by the fractures, frequent passive motion of the elbow is one of the most important factors in the treatment, or a fixed dressing which will allow a change in the position of the forearm. In the majority of fractures forced flexion is the best position, as it prevents excessive callus formation in the bend of the elbow. However, as previously discussed, this forced flexion position dislocates the fragments in certain varieties of fracture, especially supracondyloid fracture and epiphyseal separation. A splint recently advocated by Drehmann, Director of the Orthopedic Department of v. Mikulicz's clinic in Breslau,² commends itself, because, in addition to fixation, it allows change in the position of the forearm. The splint is well shown in Figs. 5 and 6. The application of the splint is as follows: The fracture is reduced. The injured arm is held in full extension. The forearm and arm are then enclosed in unpadded circular plaster bandage, which is at once cut over a cord previously placed beneath the bandage. The bandage is at once removed and dried in an oven. Flat, narrow, iron splints articulating at the elbow

¹ PROGRESSIVE MEDICINE, December, 1900, p. 135, and December, 1902, p. 104.

² Zeitschrift f. orthopädische Chirurgie, 1902, Band xi. p. 213.

are fastened to this plaster bandage. The elbow is then cut out, the edges of the cut plaster covered and provided with lacing on their anterior cut surfaces. The bandage is provided with an elastic pulley for flexion, as shown in the first illustration, and an elastic steel rod for extension. During the preparation of the splint the arm is fixed in a simple dressing. It is easily seen that this apparatus allows fre-

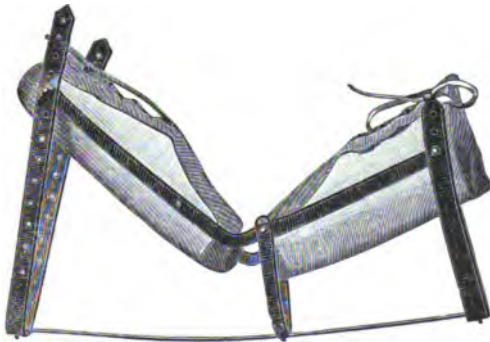
FIG. 5.



quent and easy change in the position of the forearm. The extension position is only used for a few hours during the day.

The great difference of opinion in regard to the best apparatus for the treatment of fractures at the elbow, the consensus of opinion as to the frequent bad functional results, and also anatomical results as shown by the X-ray, demonstrate that there is room for improvement

FIG. 6.



in our method of treatment. Apparently every means is exhausted, except that of early operation with direct reduction and fixation of the fragments. Our experience in this line is too limited to draw definite conclusions, and one should proceed cautiously to operation. At first, we should select only those cases in which the X-ray demonstrates our inability to reduce or retain the fragments after reduction. J. Henry

Barbat,¹ of San Francisco, is an advocate of operation in selected cases. Unfortunately, the reproduction of his skiagraphs is too indistinct for proper diagnosis. This faulty reproduction of skiagraphs is, unfortunately, the rule in the weekly journals published in this country. An X-ray photograph worthy of reproduction should appear in a plate. This is well illustrated by those reproduced by Lea Bros. & Co. in this journal. Schematic diagrams of the X-ray plates are far better than an indistinct reproduction.

A recent experience has convinced me that early operations in certain fractures at the elbow-joint promise better results than can be expected from any conservative treatment.

The patient, a girl aged five years, fell about five feet, apparently on the elbow-joint. When examined the arm was held in a slightly flexed position in medial pronation. Under narcosis there was false motion above the elbow-joint. At first one could get mobility, but not crepitus. The lower fragment with the forearm was dislocated backward and inward. By extreme forced overextension of the forearm and lower fragment, followed by pressure with the thumb on the upper fragment backward, and the lower fragment with the finger forward, associated with pulling the forearm (the upper arm held fixed) from the fully overextended position to one of flexion at a right angle, I, apparently, succeeded in reducing the posterior dislocation of the lower fragment, because at the end of this manipulation I could elicit distinct bony crepitus. I then put the forearm in forced flexion; immediately the lower fragment dislocated posteriorly, so that the manipulation just described had to be repeated to reduce the deformity. This suggested that we were dealing with an epiphyseal or supracondyloid fracture, the so-called extension fracture of Kocher.² The distinct crepitus would almost exclude an epiphyseal separation at this age. After the second reduction I found, on manipulation toward extension or flexion from a position at a right angle, that the lower fragment showed with each motion a tendency to posterior dislocation. I also found that I could not correct entirely the lateral dislocation of the forearm and lower fragment to the ulnar side. The arm was then fixed in splints with the forearm flexed to a right angle. However, I was not satisfied that I had completely reduced the deformity, and I feared that if we attempted to institute early passive motion at the elbow the fragment would be further displaced, and, on the other hand, a continuous immobilizing dressing would be associated with excessive callus and more or less joint ankylosis. An X-ray photograph was taken on the

¹ Journal of the American Medical Association, April 4, 1903, p. 885.

² PROGRESSIVE MEDICINE, December, 1902, p. 107.

fourth day. As I could not be present to remove the dressing, only an internal lateral view of each elbow was taken. We know that, at five years of age, only the capitellum and internal epicondyle of this epiphysis are ossified and throw a shadow.¹ The X-ray demonstrated this, and, although we only had a lateral view, the slight posterior and upward dislocation of the fragment was easily shown by comparing the relation of the shadow of the capitellum with the shadow of the upper end of the ulna. In the normal this shadow rested in the sigmoid fossa, in the injured arm it overlapped the ulna. The capitellum, we know, articulates with the head of the radius. This clearly showed that the ulna had dislocated upward and posterior with a small fragment of the lower end of the shaft of the humerus. As compared with the normal the lower end of the humerus was wider, the line of fracture indistinct and irregular, demonstrating the overriding of the fragments.

Having convinced myself that during the first narcosis I could not completely reduce the fracture, and, with the X-ray confirmation, I felt that an operation was justifiable. This was done on the eighth day of the injury. The incision was made over the internal lateral surface of the humerus. The ulnar nerve was exposed and dislocated from its groove. The posterior and ulnar lateral dislocation of the fragments was demonstrated, and the obliquity of the line of fracture. The fragment was composed of the ossified internal epicondyle attached to the internal condyle and a narrow piece of the lower end of the shaft of the humerus. The line of fracture was a combination of an oblique through the external condyle, and transverse through the lower end of the humerus. This is well shown in Plate I., Fig. 4, taken two weeks after operation with the arm in a fully extended position. I experienced the greatest difficulty in reducing the fragment. After it appeared completely reduced, I placed one silver-wire suture approximating the shaft and the internal condyle. When this was done one could take the forearm and make full extension and flexion without any difficulty, and inspection of the fragment through the wound demonstrated no tendency whatever to displacement. The wound was closed, and the arm fixed gently in a right-angle flexed position. Every few days the dressing was changed for passive motion, and the arm again put up in a more flexed position. At the end of three weeks no dressing, but a sling was applied. At the present writing, six weeks after operation, the child is using her arm without pain or difficulty; there is still slight restriction of full extension and flexion. The X-ray illustrated here (Plate I., Fig. 4), and taken about two weeks after operation, shows

¹ PROGRESSIVE MEDICINE, December, 1900, p. 136.

that we have not completely reduced the ulnar lateral dislocation. This can also be demonstrated clinically by palpation of the olecranon process. I, probably, could have recognized and completely corrected this if at the operation I had made a second incision over the external condyle. Therefore, anatomically we have not a perfect result, but the indications are at this time in favor of a perfect functional result. (The complete illustrations with the later ultimate result in this case will appear in the *Johns Hopkins Hospital Bulletin* for January, 1903.)

Fractures of the Lower End of the Radius (Colles' Fracture). In PROGRESSIVE MEDICINE for December, 1902, the pathological anatomy of this fracture, as illustrated by recent X-ray studies, is fully discussed, but space prevented the consideration of its treatment. I have had a number of letters requesting the most approved method of treatment. This fracture should be reduced as quickly as possible after the injury, and narcosis should be the rule. The reduction should be accomplished by very forcible manipulations (Roberts). By these manipulations the impaction is first broken up. Scudder's¹ description is as follows: "Grasp with the thumbs and forefingers of the two hands the upper and lower fragments. Free the lower fragment completely from the upper by pressure and traction backward and forward and laterally upon the lower fragment, using all the force that is needed. The lower fragment may then be forced into position by pressure of the two thumbs upon the dorsum of the wrist. When reduction is completed, the hands should be allowed to rest naturally without support to determine whether there is a recurrence of the deformity. If there is no recurrence of the deformity the fracture may be fixed. If there is recurrence of the deformity, notice should be taken of the direction of the displacement of the lower fragment, that proper pads may be applied to hold it in position." My own experience teaches me that if proper reduction is accomplished there is little difficulty in preventing secondary dislocations of the fragment. But, if reduction is not accomplished, one should not expect that any method of treatment or apparatus will prevent a bad result, which will be in direct proportion to the dislocation of the lower fragment. Not until the rule of forcible and complete reduction is understood and followed can good results be expected in fractures of the lower end of the radius in which the lower fragment is dislocated. Having accomplished this reduction the most simple method of splints will be sufficient for retention. I prefer that illustrated by Scudder (see Fig. 7). The pad over the extensor surface covers the lower fragment; the long pad over the flexor surface fills the natural curve of the radius; the

¹ Loc. cit., p. 220.

shorter pad covers the end of the upper fragment. These splints are easily fixed with adhesive plaster, and may be covered with a roll of bandage. I prefer daily change of dressing in this fracture. It allows slight passive motion and gentle massage, the bathing of the skin with alcohol, and readjustment of the pads to prevent pressure points. I am unable to convince myself that the plaster-of-Paris dressing¹ has any advantages.¹

If one fails in perfect reduction at the first narcosis, one should not hesitate to make a second attempt, also under narcosis. This should be done within the first five or six days.

FIG. 7.



Fracture of radius near wrist. Method of applying anterior splint and pad and of holding the two splints and arm for the application of straps. Another splint is cut out below the thenar eminence. (SCUDDER.)

The most recent and complete experimental and clinical study on fractures of the lower end of the radius is that of Rosenbach,² who agrees with Roberts that forcible reduction, associated with massage and various manipulation, is the most important point in the treatment of this fracture. If reduction is accomplished retention is easy. Rosenbach uses the Roser-König bandage, the principles of which are practically the same as in that just advised.

Isolated Subcutaneous Fracture of the Scaphoid Bone. Lilienfeld,³ of Leipzig, observed during eighteen months, and among 128 fractures, seven isolated fractures of the scaphoid bone of the wrist, and, as he finds but twelve cases reported in the literature, he very naturally concludes that this fracture is not rare and is frequently over-

¹ Carl Beck. Medical News, September 20, 1902.

² Archiv f. klin. Chirurgie, 1902, Band lxvi. p. 993. ³ Ibid., 1903, Band lxix. p. 1158.

looked. His article not only includes a report of his seven cases with X-ray findings, but a very interesting and conclusive set of experiments demonstrating the mechanism and etiology of this fracture. The fracture takes place when one falls on the palm of the hand, when the hand is in dorsal flexion, and in radial abduction. The scaphoid is then compressed between the radius and os capitatum (the os magnum). It is, therefore, a true compression fracture. On the other hand, if the hand is in ulnar abduction, a Colles fracture of the radius takes place. Fig. 8 illustrates the X-ray in a normal hand in radial abduction, and shows well how the compression fracture can take place. In making the diagnosis the nature of the fall, if it can be ascertained, and

FIG. 8.



FIG. 9.



the absence of the typical deformity of the Colles fracture suggest this injury. In all of his cases the hand remained in slight radial abduction, the joint effusion obliterated the fossa of the snuff-box; if the fragment is dislocated it can be palpated. In Lillienfeld's cases there was no marked dislocation of the fragments. If the hand is X-rayed in radial abduction, as a rule, the line of fracture does not show. If it is taken, however, in ulnar abduction there is no difficulty in recognizing the fracture, as shown in Fig. 9. For this reason, to exclude this fracture, one must take the photograph in ulnar abduction, a point frequently neglected. This fracture, now and then, is present with a fracture of the lower end of the radius. Untreated it may be associated with more or less impairment of motion; if recognized early the

hand should be fixed in ulnar abduction. This allows reduction of any dislocation, if present, and prevents bony union in a bad position. Passive motion and massage should be begun early. If the fragment is dislocated, which is very rare, and cannot be reduced, an operation should be performed with the removal or reduction of the fragment, as indicated. In cases seen later the dislocated fragment will have to be removed. The communication is an interesting one, and the two most important points are : the necessity of an X-ray in ulnar abduction of the hand, and the treatment in ulnar abduction.

Stinson¹ reports two cases of fracture of the carpal scaphoid with dislocation forward of the central fragment (the proximal fragment). In his first case the dislocated fragment could so easily be palpated that a clinical diagnosis of dislocation of the semilunar bone was made. At the operation the fragment was found free beneath the skin. The functional result was excellent. The X-ray taken before the operation, but not developed until afterward, differs only from the one which I have reproduced from Lilienthal in the fact that the shadow of the proximal fragment rests on the shadow of the lower end of the radius. The hand is in radial abduction. I am sorry that Dr. Stinson did not attempt reduction of this fragment by placing the hand in ulnar abduction. The second case was seen two weeks after the injury to the left radius. The radial abduction deformity mentioned by Lilienfeld was present. The forward dislocation of the fragment could be palpated; the wrist was slightly swollen. At the operation attempted reduction failed, and the fragment was removed. Stinson was able to find but three cases of this injury reported in the literature. In none of Lilienfeld's cases was this dislocation present. According to Lilienfeld, fracture of the scaphoid and dislocation of the os lunatum (semilunar bone) are the only two possible typical isolated injuries of the carpus. Von Lesser,² of Leipzig, has contributed the most complete study of this dislocation. He agrees with Lilienfeld that it is the only possible isolated dislocation in the carpus from indirect force. Its recognition, if the bone is completely luxated, is not difficult. In subluxation a clinical diagnosis is not always possible, but can be made from a lateral X-ray photograph. That the injury may be mistaken for a fracture of the scaphoid with complete dislocation of the proximal fragment is illustrated by Stinson's case. The dislocation is always forward. In recent cases it may be possible to reduce only the subluxation. If the dislocation is complete, or when one fails in reducing a subluxation, and also in older cases, the best results are obtained by

¹ *Annals of Surgery*, 1902, vol. xxxv. p. 574.

² *Deutsche Zeitschrift f. Chirurgie*, Band lxvii. p. 488.

excision of bone. A case of fracture of the scaphoid bone with dislocation of the semilunar bone is reported by Joseph A. Blake.¹ The patient was observed twenty-four hours after a fall on the wrist. I can make out in the radiograph reproduced only a fracture of the scaphoid bone, and, as the hand is in radial abduction, and the line of fracture shows well, I am inclined to think that there was a partial luxation of the proximal fragment of the scaphoid. The dislocation of the semilunar is not clear. A lateral view only would make this positive. Conservative treatment was followed with no improvement in the condition; an X-ray made later showed no change. It is in such cases that removal of the fragment is the best method of treatment, suggested by Dr. Curtis in the discussion of this case.

These injuries just discussed should be always borne in mind, and one should avoid a diagnosis of sprain or contusion of the wrist until a careful X-ray study has excluded these probable injuries.

Acetabular Fractures of the Pelvis. The recent contribution of Grässner,² from Bardenheuer's clinic in Cologne, again demonstrates how X-ray studies of fractures are changing our knowledge in regard to the occurrence of certain rare fractures. In this clinic, during a period of nine months and among 362 fractures, they observed ten of the pelvis. Of these, in seven the fracture was in the acetabulum. During the same time there were but twelve fractures in the neck of the femur. Older authorities, like Bruns, estimated that acetabular fractures occurred in only about 0.3 per cent. of cases. In this observation they were at least 3 per cent. Of these seven cases one patient died, and the autopsy demonstrated that the head of the femur had been forced into the pelvis through the acetabulum. The patient was twenty years of age, and the course of fracture in the acetabulum followed the epiphyseal line. In five cases the fracture was confined to the acetabulum alone and of a lesser degree. The diagnosis may be made on the following clinical picture, which is pretty uniform: Local pain is produced by pressure on the trochanter, and also when the limb is pushed in a straight position against the pelvis. As a rule, the flattening of the trochanter is more marked than in impacted fracture of the neck of the femur. There is little or no shortening between the anterior iliac spine and trochanter. Outward rotation present in fracture of the neck of the femur is not observed. Inward rotation is painful and limited. Palpation over the acetabular and below Poupart's ligament elicits tenderness. Rectal examination is most important. In fractures of the neck of the femur this is negative; in

¹ *Annals of Surgery*, 1901, vol. xxxiv. p. 298.

² *Deutsche Zeitschrift f. Chirurgie*, 1902, Band lxiv. p. 576.

fractures of the acetabulum there is always tenderness, and sometimes one can palpate the bulging if the fragments are pressed inward by the head of the femur. In all of these cases crepitus was absent. The cause of death in the case mentioned above was due to a tear of the iliac vein. In the remaining cases there were no serious injuries. The X-ray photograph excludes the fracture of the upper end of the femur and shows more or less bulging of the acetabulum into the pelvis. The method of treatment which was satisfactory in all these cases was Bardenheuer's extension, and, as we know, this surgeon always combines longitudinal with lateral traction, so that in this fracture, in addition to the usual extension of the leg in a longitudinal direction, lateral traction is made in the upper portion of the thigh, the object of which is to draw the head of the femur out of the acetabular cavity.

Fractures of the Neck of the Femur. Coxa Vara. This subject was fully considered in *PROGRESSIVE MEDICINE* for December, 1899 and 1900, and it is very satisfactory to read in a recent communication of Hoffa,¹ of Berlin, a confirmation of the views there expressed. Hoffa, in reporting ten cases in which the diagnosis was confirmed by X-ray or operation, states that the number now in the literature is eighty-eight. He mentions the cases of Royal Whitman, Sprengel, Rammstedt, Wolff, Mayer, and Joachimsthal, which I previously discussed. He also calls attention to an extensive article by Gerstle,² written in 1899, who at that time collected fifty-three cases, and a more recent one by Pels Leusden.³ Hoffa's contribution, which completes this subject up to date, adds nothing new, but is of value in confirmation of previous experience. He agrees with the majority in the statement that the fracture is usually in the epiphyseal line between the head and neck, disagreeing with Royal Whitman's statement, who, from a clinical experience in nine cases and a specimen in one, advanced the view that the common seat of the fracture was in the neck, and not in the epiphyseal line. According to Hoffa, among the eighty-eight cases in the literature, in only four have we pathological or X-ray proof that the fracture was in the neck and not in the epiphyseal line. Single cases were reported by Royal Whitman, Pels Leusden, Mayer, and Hoffa. The anatomy of this so frequently overlooked fracture in young individuals must now be considered established as a partial or complete epiphyseal separation in the majority of instances. The age of the patient in these cases varied from one to twenty years; the most common age is between thirteen and sixteen years, but it is very

¹ *Zeitschrift f. orthopädische Chirurgie*, 1903, Band xi. p. 528.

² Dissertation, Würzburg, 1899, with bibliography up to 1899. This dissertation I was unable to obtain.

³ *Archiv f. klin. Chirurgie*, 1902, Band lxvi. p. 679.

important to bear in mind that seventeen cases have been observed between one and five years of age. The complete separation is much less common than the incomplete. The former produces immediate symptoms and can be easily recognized clinically; the latter, the incomplete separation, gives little or no immediate symptoms, which only develop later, weeks or months, and, as the injury may have been slight, a diagnosis of tuberculous coxitis is frequently made. Hoffa divides the cases into two groups: (1) in which the epiphyseal separation takes place in healthy children, and (2) in which the fracture occurs in a femoral neck the strength of which is weakened by some pathological process. In the first group the symptoms all date from the injury; in the second group a history of certain typical symptoms can be obtained which become exaggerated after the injury. Hofmeister was fortunate enough to observe a case of true coxa vara in which the diagnosis was confirmed by the X-ray. Eighteen months later this patient had a slight fall, and the X-ray showed a definite epiphyseal separation. Non-traumatic coxa vara, therefore, predisposes to traumatic coxa vara. In the majority of instances it is difficult to divide these cases into these two groups. The clinical picture, as discussed before, is one that should not be overlooked. At various intervals after a slight injury the young individual begins to complain of pain in the hip and walks with a limp. On examination we find shortening, adduction, outward rotation, and, as a rule, some flexion. Abduction and inward rotation are limited. This deformity, restriction of motion, and loss of function vary in degree. An X-ray will confirm the diagnosis.

The knowledge of traumatic coxa vara and its frequency has a most practical bearing to the general practitioner. Recognized early and properly treated this condition will never advance to that stage of deformity and loss of function which can only be relieved by operative interference, and, although the operation improves and checks the progress of the deformity, the limb can never be restored to perfect function. In young individuals most careful scrutiny should be given to the slightest pain referred to the hip or to a limb. Even after the most trivial injuries in the region of the hip-joint the possibility of a traumatic separation should be borne in mind, and can be only excluded by an X-ray examination. If recognized after the injury the patient should be treated at first with extension in bed as in an ordinary fracture. After healing is complete they should wear, for a year at least, a supporting hip-splint. This is a point in the treatment usually neglected. If recognized later the same treatment should be followed. One, however, can expect from the prolonged use of the splint only prevention of further deformity.

In both the extension and the supporting splint the leg should be in abduction.

In deformities and loss of function of extreme degrees, after a few weeks' treatment in bed with extension and massage, operative intervention is the only method of treatment. According to Hoffa, the choice lies between a subtrochanteric oblique osteotomy and a resection which removes the head and some of the neck, or a more extensive resection of head, neck, and part of the trochanter. The osteotomy is performed when joint motion is not greatly restricted, and the resection when the head of the femur is considerably dislocated. This is always associated with more joint restriction. Hoffa does not advise wedge-shaped osteotomy of the neck.

My personal experience in four cases favors sufficient resection of the head to allow the complete reduction of the deformity. In some instances the entire head must be removed. The part left is placed in the acetabular cavity. The results so far have been associated with correction of the deformity, with shortening but slightly less and joint motion somewhat greater than previous to operation.

A recent observation demonstrates the difficulty in some cases to make a differential diagnosis between traumatic coxa vara and tuberculosis of the hip. I saw this patient, a girl aged fifteen years, twelve years after the injury. Her mother informed me that when she was three years old, and a perfectly healthy child, the right hip was bruised by a fall against the edge of a stone. On account of pain and swelling about the hip-joint the child was treated in bed with extension for eight weeks, and was not allowed to walk without crutches for three months. During the next nine years the apparently healthy child would complain at intervals of pain in the hip and would walk with a slight limp. These attacks were generally associated with over-fatigue. In the fall of 1902 the patient went mountain-climbing with her parents. It was at once observed that she tired quickly, and with great difficulty kept up with the rest of the party. On returning home she complained more constantly of pain in the hip and walked with a distinct limp. A few months later, in January, 1903, she was examined by Dr. Willis, of Seattle, Washington. Forced motions at the hip-joints were painful, and there was 1.5 cm. measured shortening between the anterior iliac spine and the internal malleolus. The circumference of the affected right thigh was but slightly less than the left. There was a tender point beneath Poupert's ligament over the hip-joint. The patient was placed in bed in extension for six weeks, and was given massage and passive motion. She then was allowed to get up in a fixation splint, walking with crutches, with a high shoe on the foot of the unaffected limb. I examined the patient in July, six months later.

For the last six weeks she had discarded her splint, simply walking with crutches. When the patient lay flat on her back with limbs extended there was an apparent shortening of 1 cm., which could be obliterated by extension. After repeated and most careful measurements I could get a difference between the anterior iliac spine and internal malleolus of but a few millimetres. The patient was so well developed over the hips that accurate measurements between the iliac spine and trochanter were difficult. There appeared to be about 4 mm. real shortening. There was slight restriction of motion in complete flexion, abduction, and internal rotation. The circumference of the right calf was about 1 cm. less than the left. The patient did not react to two doses of tuberculin. The X-ray showed a normal neck, but the relations between the head and the neck were apparently slightly changed. The angle was a little more acute. It appeared to me that the clinical history and picture in this instance could be more easily explained by a partial separation of the epiphysis, which, fortunately, had been properly treated at the time of the injury, than by tuberculosis. The patient was advised to wear the protective splint for six months or a year.

The recognition and treatment, therefore, of fractures of the neck of the femur in youthful individuals before ossification of the epiphysis is now well established. When seen early the ordinary extension treatment is sufficient. In a few instances, associated with greater trauma, the head of the femur is dislocated, and the deformity cannot be reduced by manipulations. This dislocation can be recognized clinically by the greater deformity and more restriction of motion at the hip. An X-ray will render the diagnosis positive. In these cases immediate operations should be done, and in the majority of cases the dislocation can be reduced. The best incision for the exposure of the fracture is one separating the tensor vaginæ femoris to the outer side, the rectus and vastus externus to the inner side (Barker's incision). In all these cases, whether seen in the recent state or not, the youthful individual should wear supporting hip-splints for at least a year.

The recent articles by Blum,¹ on coxa vara as a burdening deformity, and by Haedke,² on the etiology of coxa vara, are of interest only in the confirmation that their own recent experience and that in the literature give to the view already discussed in previous numbers of PROGRESSIVE MEDICINE.

Fracture of the Neck of the Femur in Adults. The loss of function after this fracture is usually so great that with the rarest

¹ Archiv f. klin. Chirurgie, 1903, Band lxi. p. 1065.

² Deutsche Zeitschrift f. Chirurgie, 1902, Band lxi. p. 89.

exceptions the physician always sees this injury in its recent state. The diagnosis should never be difficult. On the other hand, results of treatment are by no means satisfactory. In some instances there is non-union of the fragments. Union when it does take place is usually associated with deformity. This deformity is of various degrees. The functional results correspond fairly closely to the amount of the deformity. In addition, I am inclined to the view that many cases which leave the hospital, apparently with good union and not great deformity, develop coxa vara statica due to overburdening of the neck of the femur united to the shaft at a bad angle. Our experience, which has demonstrated the necessity of longer support for fractures of the femoral neck in youthful individuals, I think, should be followed in older cases until we have established whether it is necessary or not.

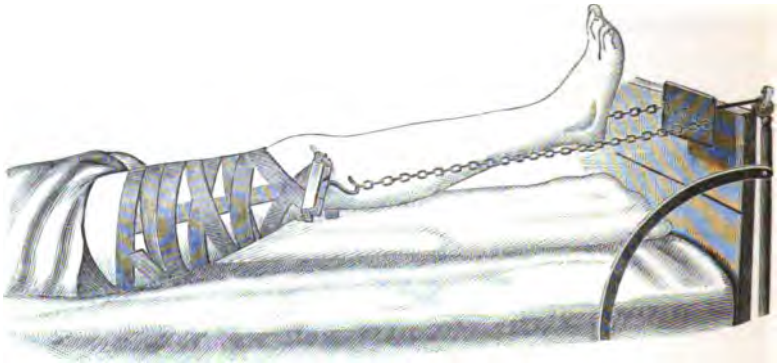
Opinions in regard to the treatment of this fracture in the recent state vary. A few advocate no apparatus whatever (Bier), but simply to keep the patient in bed. The majority of authorities use simple extension; others fixation in a plaster cast, or a great variety of apparatus to allow ambulatory treatment; while a few advocate operative intervention with reduction and fixation of the fragments. My own experience and the reading of the literature do not allow any definite statement, except that there is room for great improvement in our results, and that the method of treatment must vary with the general condition of the patient, the position of the fragments, and the ability to keep the fragments properly reduced. The latter can only be ascertained with certainty by the use of the X-ray.

Bissell¹ has studied the results after the various methods of treatment employed at the New York Hospital. In none of these cases was operation employed. In practically all, the principal treatment was rest in bed with extension. In the New York Hospital, in which Bissell claims the best results were obtained, Hodgen's splint was employed in the majority of cases, in a few Buck's extension in the early days. Bissell's contribution has the usual defect present in the majority of contributions on the treatment of fractures of the neck of the femur, in that the conclusions are based on the results obtained in the hospital, and not upon the ultimate result a few months or years later. One can see that Bissell is not satisfied with any method of treatment which keeps the patient in bed, but is inclined to the view that such patients should soon be allowed to walk in a plaster-of-Paris cast or some form of ambulatory apparatus. He also claims that the risk of surgical operations in these cases is not so great "as that of the tedious, slow, and unsatisfactory treatment without cutting." But,

¹ Philadelphia Medical Journal, May 30, 1903.

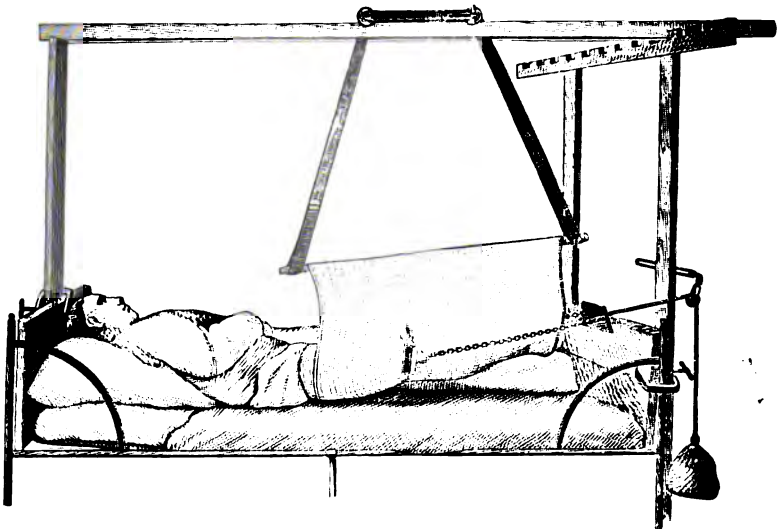
as Bissell does not record any cases of operation, this statement **cannot** be considered as confirmed by the experience of the New York Hospital. Thomson¹ advocates that the best results are obtained by

FIG. 10.



reduction and immobilization under narcosis, and fixation in a plaster-of-Paris cast ; that these patients should not be allowed to bear weight on the limb for at least three months.

FIG. 11.



It will be a long time before we can persuade the general profession to give up prolonged extension treatment in these fractures, but I am inclined more and more to the view that this should be shortened. For the first week after the fracture extension seems the better method.

¹ Journal of the American Medical Association, January 3, 1903, p. 17.

During this time there should be counterextension to produce abduction and internal rotation. Now the limb should be fixed in a plaster-of-Paris cast in a position of abduction and internal rotation under general narcosis, if not contraindicated by the general condition of the patient, when the X-ray shows that the fragments are not in position. During the day the patient can be up and about on crutches, and at night extension should be added. This dressing should be replaced at least once a week. The various ambulatory apparatus are too complicated for general use, and a plaster splint advocated by Wolkowitsch¹ appears to me to be more complicated and no better than a simple plaster cast. As we study our cases more carefully we will soon learn to differentiate those cases in which early operation is indicated, and, as our experience in operative intervention increases, its field of usefulness may enlarge.

NEW METHODS OF EXTENSION. Recently, Klapp,² from Bier's clinic, has advocated a method of extension which allows motion at the knee and hip and in which, as the adhesive plaster is applied to the thigh only, the knee is relieved of the usual strain. Fig. 10 shows the method of extension and Fig. 11 the method of swinging the leg which allows the patient to make motions in the hip-joint and knee-joint. The method appeals to one in cases in which we desire prolonged extension, which may be necessary in a few cases of fracture of the neck of the femur and in some oblique or spiral fractures of the shaft.

Spiral Fractures of the Shaft of the Femur. In Bardenheuer's clinic in Cologne Dietzer's³ X-ray studies of fractures of the shaft of the femur demonstrate that the spiral fracture is much less rare than previously considered. The clinical picture is not sufficiently characteristic, and the positive diagnosis rests upon the X-ray. In children the site of the fracture is usually in the middle third, in very old people at the junction of the middle and upper third, and in younger adults between the middle and lower third. In many cases the fracture is due to indirect force. In all of his cases except one the spiral fracture was due to an indirect force; falling on the feet with torsion of the body. In one instance, in a boy aged ten years, the femoral spiral fracture was due to direct force; the leg was run over by a wagon. It is important to note that in all of Dietzer's cases, after the reduction of the fracture, the treatment employed was that of extension, as modified by Bardenheuer. The principles of this method of extension consist of longitudinal extension with very heavy weight (twenty-five to thirty pounds). This corrects the overriding of the fragments. In addition,

¹ Loc. cit.

² Archiv f. klin. Chirurgie, 1903, Band lxi. p. 167.

³ Deutsche Zeitschrift f. Chirurgie, 1901, Band lxi. p. 260.

it is always combined with lateral traction in one or both directions to overcome the separation of the fragments. Dietzer's results are unusually good. He states that the average shortening in all his cases was about 2 mm. In one of his cases¹ the etiology and the line of fracture correspond exactly to the case which I have previously discussed in the shaft of the humerus (see Fig. 1, Plate I.). In his other cases there was no third fragment. The importance of this contribution consists chiefly in the fact that it demonstrates that excellent results with very little shortening can be obtained by extension properly applied.

Spiral Fractures of the Leg. Until the article of Zuppinger,² in 1900, appeared, our knowledge of spiral fractures was very defective. This surgeon's clinical observations confirmed by X-ray studies and his experimental investigations have established conclusively the etiological factors and the more common occurrence of this fracture. Among fifty-nine fractures of the bones of the leg, in twenty-three the line of fracture was of a spiral form. During the same time he observed but one spiral fracture of the humerus and none of the femur. This observation demonstrates that the spiral fracture was much more frequent than the oblique. To demonstrate this fracture, one must take an anteroposterior and a lateral view of the leg. The spiral fissure always runs over the anterior surface of the tibia, the long fissure in the posterior surface of the tibia. This spiral line in twenty-two of Zuppinger's cases extended from a medial (inner) and lower point on the shaft upward and outward; in only one case in a reversed direction, *i. e.*, from a lower and outward to an upper and inward.

Zuppinger's conclusions may be briefly stated to be as follows: The younger the individual and the less the force of torsion, the less frequently is the fibula fractured. Outward rotation of the foot by application of force to the anterior half of the foot causes a spiral tibial fracture in the lower half with terminal fracture in the posterior part of the tibia; if the force of torsion continues after the fracture of the tibia it will produce a fracture of the fibula at a higher point, except in young individuals, in whom the elasticity of the fibula is often sufficient to resist fracture. The spiral line is right on the left tibia and left on the right tibia. This is shown in Fig. 1, Plate II., the left leg of a patient aged forty years. *a*, posterior view; *b*, inner lateral view.

Inward rotation of the foot by application of the force in the anterior half of the foot causes a deep torsion fracture of the fibula and, eventually, a fracture of the internal malleolus; the spiral is left on the

¹ Deutsche Zeitschrift f. Chirurgie, 1901, Band lxi. p. 265.

² Beiträge zur klin. Chirurgie, 1900, Band xxvii. p. 735.

PLATE I.

FIG. 1.

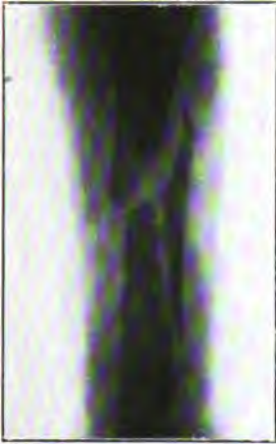


FIG. 2.



FIG. 3.

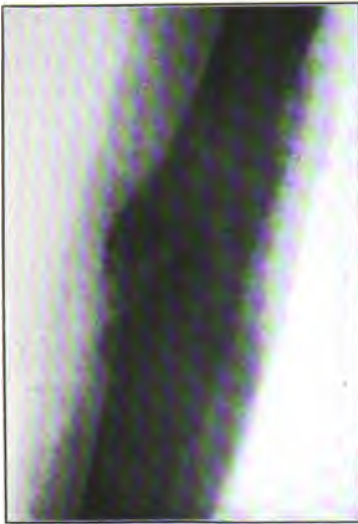


FIG. 4.



PLATE II.

FIG. 1a.



FIG. 1b.



FIG. 2a.



FIG. 2b.



left leg and right on the right leg, *i. e.*, in this instance the force is directly opposite to the one in the previous group, and gives rise practically to a reverse fracture, namely, a high fibula and a low tibia (Pott's fracture).

Outward rotation of the foot by application of the force to the outer side of the heel causes a deep torsion fracture of the fibula and, eventually, a fracture of the internal malleolus. The spiral in this case is left on the right and right on the left leg.

Inward rotation of the foot by application of force to the inner side of the heel causes a torsion fracture in the lower half of the tibia with posterior terminal fracture and a deep fracture of the fibula; the spiral is right on the right leg and left on the left leg. This fracture is well illustrated in Fig. 2, Plate II., a patient aged fifty-six years. *a*, posterior view; *b*, inner view. This is the so-called supramalleolar fracture.

Zuppinger states that reduction can be accomplished in these cases without operation by strong extension on the lower fragments with rotation and manipulation according to the spiral line. In his twenty-two cases good results were accomplished without operation.

Lauenstein's¹ more recent contribution confirms Zuppinger's work.

In the Marine Hospital at Hamburg, from July, 1900, to November, 1902, a period of two years and four months, and among 175 fractures of the diaphysis, Lauenstein observed 32 spiral fractures. Among 26 fractures of the humerus 2 spiral, 1 in 27 fractures of the forearm, 4 among 37 fractures of the femur, and 25 spiral fractures among 85 diaphyseal fractures of the leg.

These 25 spiral fractures of the leg may be classified as follows: recent, typical, of both bones of the leg, 13; old, 2; recent, typical, tibia, 5 (all young individuals); recent, supramalleolar, of both bones, 3; recent, typical, spiral fracture of the fibula with fracture of the internal malleolus, 2 cases.

The clinical varieties of spiral fractures observed by Lauenstein correspond closely with those produced experimentally by Zuppinger, the two most important varieties of which we have illustrated. Figs. 12 and 13 represent typical spiral fractures of both bones, ten and two years, respectively, after the injury, and give one an idea of the usual result after the non-operative treatment. In these two cases the shortening was very little and the functional result excellent. These patients were admitted for other injuries.

These observations demonstrate that in spiral fractures of the tibia we must always bear in mind that the fibula is also fractured, especially in adults. The most common position for the tibial fracture is the

¹ *Deutsche Zeitschrift f. Chirurgie*, 1903, Band lxvii. p. 455.

middle third, near the lower third, the fibula higher. The fibula is frequently comminuted, the tibia rarely. In supramalleolar spiral fractures both bones are broken at about the same level, and in this instance the tibia is more frequently comminuted.

In the clinical diagnosis the supramalleolar fracture and the fracture of the fibula and internal malleolus are not difficult to diagnose. The more common fracture of the tibia higher up, with or without the accompanying fracture of the fibula, is a very difficult one to diagnose

FIG. 12.



FIG. 13.



clinically. The history of indirect force by a fall on the foot with outward rotation of the foot suggests the injury, but a positive diagnosis can only be made by the use of the X-ray. Lauenstein agrees with Zuppinger that these fractures can be treated without operation. He, however, admits that reduction is frequently quite difficult, especially to overcome a dislocation *ad latus* (gaping of the fragments). Lauenstein's method of treatment is simple; in the early days ordinary splints with local pads to correct the lateral deformity, later a plaster

cast. Examined critically, however, his results in a number of cases are not as perfect as one should desire; shortening was present in various degrees in many of his cases, and in a few it was necessary to operate later to remove a projecting piece of the tibia. Although my experience with this variety of fracture is limited, I should be inclined to operate in all cases which are compound, and in those simple fractures in which the X-ray demonstrated incomplete reduction.

These observations, however, assure one that bony union is not delayed in this form of fracture.

Bliesener¹ and Wolff² both advocate v. Bardenheuer's method of extension in all varieties of fractures of the leg. This method, however, although it seems to give good results, needs daily supervision and keeps the patient in bed, and for this reason I agree with Lane, Helferich, and others,³ that in fractures of the leg operative interference in recent cases is indicated when the X-ray shows that the fragments cannot be properly reduced, or when reduced cannot be retained by some simple dressing which will allow the patient to walk. Fractures of the tibia and fibula present the least contraindication to operation on account of the superficial position of the tibia in its entire extent, and the fibula in most of its extent. In the majority of cases after fixation of the tibia it is unnecessary to expose the fibula. In addition, it is of the utmost importance to bear in mind that in fractures of these bones near the ankle very little deformity produces a change in the angle of burden between the foot and leg and is usually quickly followed by the development of flat-foot symptoms which will demand for their relief apparatus or operation.

Fractures of the Upper Epiphysis of the Tibia. Schlatter,⁴ of Zürich, gives us an interesting X-ray study of the ossification of the upper epiphysis of the tibia, especially in relation to the bone centre which forms the so-called tubercle of the tibia, and he has demonstrated that the tubercle is formed by two centres of ossification, one lower down, at first isolated, and the second as a projection from the upper epiphysis, so that they form a beak-like process. The two bone areas are separated by cartilage up to the eighteenth to twentieth year. The form of this beak-shaped process from the upper tibial epiphysis is well illustrated in Fig. 14. The lower ossification does not appear until about the twelfth year. The fracture takes place between the foci of ossification, and is, therefore, possible between the ages of twelve and eighteen years. In Schlatter's twelve cases the ages of the patients varied from twelve to seventeen years.

¹ Deutsche Zeitschrift f. Chirurgie, 1900, Band lv. p. 275.

² Centralblatt f. Chirurgie, 1901, p. 123.

³ Loc. cit.

⁴ Beiträge zur klin. Chirurgie, 1903, Band xxxviii. p. 874.

This fracture usually follows a direct contusion, and, as the dislocation of the small lower fragment may be slight, the diagnosis in the recent state is usually that of traumatic arthritis. In the later stages, because the local pain and tenderness do not disappear, and on account of callus formation, a swelling appears over the head of the tibia, a diagnosis of pyogenic or tuberculous osteomyelitis of the head of the tibia is not infrequently made. In some instances it might be confused with a new-growth. Fig. 15 is a later X-ray view of a boy aged thirteen years. He was admitted to the clinic because of local pain and tenderness over the head of the tibia of some months' duration following a slight trauma. On palpation the bony tumor could easily be felt. The X-ray shows slight dislocation of the fragments, enlarged by callus formation, and the cartilage separation which we know is present between the two islands of ossification at this age.

FIG. 14.



FIG. 15.



The importance of this communication lies chiefly in the fact that this injury will explain many of the cases in which local pain and tenderness remain months and even up to two years after a contusion of the knee, and in which one might suspect pyogenic or tuberculous osteomyelitis or a new-growth. A lateral X-ray picture will at once make the diagnosis. If recognized in the recent state treatment with fixation for two or three weeks will be sufficient (Case 7 of Schlatter), and will relieve the patient of the prolonged local pain and tenderness observed in neglected cases. Recognized later the same fixation treatment may be tried, but, as a rule, it is some time before the local pain and tenderness disappear. But, in these cases, having demonstrated the etiology of the local symptoms, the patient can be assured that there is no serious lesion. In none of Schlatter's cases

was there the dislocation of the fragments or the callus formation sufficient to indicate an operation.

The development of this beak-shaped process of the upper tibial epiphysis has also recently been investigated by Ludloff,¹ and it is very satisfactory to note that his X-ray studies confirm those of Schlatter. This article will be discussed more fully in the chapter on the "X-ray Diagnosis of Tuberculous Osteomyelitis."²

TUMORS, BENIGN AND MALIGNANT.

In the field of surgery assigned to me in *PROGRESSIVE MEDICINE*, that of the extremities, the consideration of tumors, except bone tumors, has been postponed. I did this purposely until I had completed a study of the tumors observed in Prof. Halsted's clinic in the Johns Hopkins Hospital. I felt that I could discuss with better advantage the literature after I had thoroughly investigated the experience of the clinic with which I am connected. This, fortunately, was completed during the past year, summarized and presented to the class in surgical pathology in the form of pamphlets. The conclusions from this rather extensive investigation appear to me of the utmost importance, because one is able to state in exact figures the percentage of cures in every variety of tumor met with in the clinic during its experience of fourteen years. It affords an opportunity to contrast the operative results in carcinoma and sarcoma of almost every variety with the results published of the X-ray treatment of malignant tumors.

The terms "innocent" and "malignant" employed by Bland Sutton in his excellent text-book on *Tumors* are most appropriate, and we can use them in formulating a law in regard to the treatment of tumors directly opposite to the almost universal law applicable in the trial of individuals accused of crime, namely, *a tumor should be considered malignant until every means has been exhausted to demonstrate that it is innocent*. Also in regard to tumors, in contrast to the treatment of individuals, lynch law is by far the better procedure than the "due process" so frequently followed in waiting for developments.

The great majority of malignant tumors have a definite period of local growth before metastasis takes place. With rare exceptions such a tumor gives evidence of its presence sufficient to attract the attention of its host before general dissemination. It is in this period that removal gives the best results. The responsibility, therefore, of the physician whose advice is sought shortly after the first signs of a tumor

¹ Beiträge zur klin. Chirurgie, 1903, Band xxxviii. p. 64.

² *PROGRESSIVE MEDICINE*, December, 1904.

is great. The general public should be educated to this fact, so that they will consult physicians the moment they observe any evidence of tumor formation. For the physician or surgeon there should be but one rule in regard to the treatment of a tumor, and that rule should be an immediate decision. Only in those cases in which the clinical history and picture are pathognomonic of its benignity should any delay be allowed. Every other operable tumor should be subjected to immediate removal. Yet, how seldom is this rule followed!

Before the advent of the X-ray treatment of malignant tumors it appeared to me that the general profession and public were being educated up to the early recognition and operative removal of the various forms of tumors, and the last few years, especially with breast tumors, carcinomata were referred to the surgical clinic at a strikingly earlier period of the disease, and the ultimate results were improving accordingly.

Due to the voluminous literature and newspaper articles on the X-ray treatment of tumors, individuals adverse to the use of the knife have sought first cure from the X-ray, and apparently have not had great difficulty in getting this treatment, thus delaying the early operative removal. Although the majority of writers advocate the use of the X-ray only in inoperable malignant tumors, nevertheless a general impression has apparently been created that it is justifiable to attempt this treatment first in any form of tumor. It has opened an avenue of great profit to unscrupulous individuals belonging to the same class who advertise in the newspapers as doctors of medicine. The general profession should feel their responsibility and use every proper means to correct this wrong impression, and let the public know the proper field for the X-ray in the treatment of malignant disease.

The results of the complete excision of tumors, even in those cases with metastasis to neighboring glands, are far too good to be substituted by any new method of treatment until its value is established under skilled observers in appropriate cases.

The study of the tumors treated in Prof. Halsted's clinic has established the fact that malignant tumors vary extremely in their degree of malignancy, and it is of the utmost importance that each tumor be subjected to a most critical pathological study, and that the ultimate results be tabulated according to the pathological variety. It not frequently happens, especially in sarcomata, that tumors of apparently high malignancy histologically must be considered, because of their clinical history and ultimate result, much less malignant, that is, the cellular architecture of a tumor is not always an index to the degree of malignancy. This fact has been commented on before by the most eminent surgical pathologist, Billroth, of Vienna.

In presenting tumors to the students in surgical pathology I have adopted the following classification.

The first pamphlet is a consideration of the benign connective-tissue tumors. They are discussed together, in order that the student may be able to contrast them with the various malignant connective-tissue tumors which have a benign prototype, and in the following discussion it seems better to consider first the malignant tumors, and discuss the benign prototype at the same time.

The malignant connective-tissue tumor, the sarcoma, has been presented in three pamphlets: sarcoma of the skin, of the soft parts, and of bone.

Sarcoma of the Skin. During the thirteen years of the clinic, and among 15,000 cases, there were observed forty-two cases which may be considered sarcomata arising from the connective tissue of the skin. These apparently fall into the following classifications:

1. **LYMPHANGIOSARCOMA.** (Twenty-seven cases.) Histologically these tumors are endotheliomata, the so-called melanotic alveolar sarcoma. Clinically they appear in two groups: (a) those originating in congenital moles (fourteen cases); (b) those in which the patient had not observed a congenital tumor, although with great probability there was a minute embryonic area of lymphangioma (fourteen cases).

2. **HÆMANGIOSARCOMA.** (Seven cases.) Histologically these tumors have been in every case so far observed of the perithelial variety; a few have been pigmented. Here, also, there are two clinical groups: (a) those in which the malignant tumor grew from a congenital nævus (three cases); (b) those in which the patient had not observed a vascular congenital nævus.

3. **SARCOMA** arising from the connective tissue in skin scars. (Three cases.) One was a pure spindle-cell sarcoma; two were mixed spindle-cell and round-cell sarcomata.

4. **MYCOSIS FUNGOIDES**, a rare multiple sarcoma of the skin. (One case.)

In studying the ultimate results of these forty-two cases we become impressed with the malignancy of skin sarcoma. Only four cases, about 10 per cent., have been cured. As the majority of these sarcomata arise in congenital tumors, moles, or nævi, one immediately asks the question, Can we recognize these tumors at a period when their removal will be followed by a cure.

CONGENITAL MOLES. During the same period there were observed fourteen malignant and fourteen benign tumors of this variety. A congenital mole rarely becomes malignant in our observations before fifty years of age. In only three did the patients seek advice because of a change in the mole. Three cases came to the clinic because of

slight growth in the mole and symptoms of metastasis. Two were admitted for metastatic tumors after the removal of a congenital mole, and three were only aware of the metastatic tumors, their attention not having been called to the pigmented mole. All of these patients died within a year of internal metastasis in spite of operative intervention. Three patients were admitted to the clinic with a history that the congenital mole had been excised and that a tumor had formed in the scar. In two of these cases the recurrent tumors formed in the scar at least two years after the removal of the mole, and the tumors were of one and two years' duration. Histologically they were fibro-spindle-cell sarcomata. These two patients have remained well five years since operation. Without doubt the congenital moles were not malignant. The long duration of the recurrent tumor and the interval of time before its formation in the scar were factors from which a good prognosis could be made. In the third case the recurrent tumor formed almost immediately after the excision of a pigmented mole under the arm. Histologically the tumor was a melanotic endothelioma, and the patient died eleven months after the operation from internal metastasis. These observations demonstrate the hopeless prognosis in congenital moles which have become malignant. The duration of life from the time of the first observed change in the mole is usually no longer than one year. When we compare the clinical picture of the malignant with the benign congenital mole we are impressed with the fact that all the patients with benign moles were under fifty years of age, and usually sought advice for cosmetic effects. The ultimate result in every one of these cases has been followed; there are no recurrent tumors in the scar and no signs of internal metastasis. Many of these were hairy moles. In very few cases had there been any growth in the mole itself. In those in which the tumor had increased in size it could be demonstrated histologically that the growth was due to a fibrous hypertrophy of the connective tissue in a zone beneath the congenital areas of lymphangioma.

Recently the number of benign congenital moles has increased owing to the fact that we advise their removal in patients admitted to the clinic for other reasons.

A congenital mole is apt to become malignant after fifty years of age. A malignant change in a hairy mole is seldom, if ever, observed. The dangerous mole appears to be the one that is slightly elevated and in a position subjected to repeated trauma. The mole with a smooth covering of epidermis appears to have a greater tendency to become malignant than the one with a warty surface. The first change appears to be a superficial ulceration. Histologically this is due to a proliferation of the endothelial cell beneath the very thin epidermis. The

probabilities are that internal metastasis takes place very quickly after the first cellular change toward malignancy in the mole. It is for this reason that we should be constantly on the alert and advise the removal of moles in positions where they are constantly exposed to slight trauma, especially the smooth, elevated mole. The moment any growth is observed in any congenital mole, or the slightest change of any kind, it should be completely removed with the knife, and not with caustics. The very high grade of malignancy of this form of tumor is apparently not appreciated by the general profession.

ACQUIRED MOLES. Except for the absence of a history of congenital tumor the clinical history and picture are similar to that of the malignant congenital mole. The patients are usually over fifty years of age. The size of the primary tumor is usually small. Superficial ulceration of the thin epidermis is early. Of the fourteen cases, thirteen died of internal metastasis, usually within a year. In five cases there was no evidence of internal metastasis when the mole was excised. In one patient there was a history of an excision of what may have been an acquired mole eight years previously. A few years later there was a recurrence in the scar. Histologically the tumor was a fibro-spindle-cell sarcoma, and the patient has remained well three years after the operation. In this observation, similar to the two of recurrent tumors in the scar after the excision of congenital moles, the probabilities are that the primary tumor was not malignant. Excluding, therefore, these three cases, we have on record not a single cure among twenty-five lymphangiosarcomata arising in the skin.

It is of the utmost importance, therefore, to remove at once the acquired mole, and to be on the lookout for and to advise the complete excision of all congenital moles in which there is any possibility of their becoming malignant.

Whitehead,¹ in a study of malignant tumors arising in congenital moles, gives us a discussion of the various and conflicting views in regard to whether these tumors should be classed as sarcoma or carcinoma. Unna, in 1893, was one of the first to advocate that they should be classed as carcinoma. His opinion was based upon the study of moles removed from the newborn and very young children, and he claimed that he was able to demonstrate that the pigmented cells were derived from the epidermis during embryonic life. Gilchrist² is of the same opinion. The majority of authorities, however, favor the endothelial origin. Practically these tumors undoubtedly belong to a distinct type and differ in every respect from every other epithelial

¹ Johns Hopkins Hospital Bulletin, 1900, vol. xi. p. 221.

² Journal of Cutaneous and Genito-urinary Diseases, March, 1899.

tumor of the skin. Clinically and pathologically they differ little, if any, from endothelial tumors originating from other tissues.

Ravogli¹ reports a pathetic case which illustrates my point with regard to the treatment of congenital pigmented moles. The patient was a woman, aged thirty-three years, the pigmented, warty skin tumor the size of a twenty-five-cent piece, near the sternum. No growth was observed in the congenital tumor until her second pregnancy. It was excised very quickly, but within two months the patient was covered with pigmented skin metastases. The patient died within a few months. Ravogli from his microscopic study is inclined to view the tumors as pigmented carcinomata similar to Unna.

In November, 1902, I observed a similar congenital tumor on the abdomen in a patient referred to me for gallstones. During three pregnancies this warty, pigmented mole had stretched with the abdominal wall and would bleed a little. Fortunately after delivery it would return to its normal size. I had some difficulty in persuading the patient to consent to its removal, but such congenital moles should always be excised. If this is done cases like Ravogli's will become rare.

BENIGN HÆMANGIOMA AND HÆMANGIOSARCOMA. The tendency of the benign or acquired hæmangioma to become a malignant tumor is apparently very much less than of the lymphangioma or mole. We have observed but seven cases. In three the tumors developed in congenital nævi. The patients were forty-six, forty-three, and forty-three years of age, the tumors of seven months', four years', and two years' duration. The congenital nævi were situated in the groin, over the ribs, and over the sternum. The first change noted was increase in size, then an ulceration of the thin epidermis, with the formation of a rather large fungous tumor projecting from the skin. These three patients died of internal metastasis, two within a year after operation, one two years and four months. Histologically they were perithelial angiosarcomata; one was pigmented. As compared with the congenital mole a malignant change in the congenital nævus is easy to recognize, and I am inclined to think that if there had been an opportunity for earlier operative intervention in these three cases before the formation of metastasis the result would have been different. The slightest change, therefore, in a congenital nævus should demand attention, and in the majority of instances complete excision. However, when we study our benign hæmangiomata of the skin, acquired or congenital, we find that growth frequently takes place in the vascular tumor which is due, not to a malignant cellular formation, but to

¹ Journal of Cutaneous and Genito-urinary Diseases, June, 1901.

one due in the majority of instances to an increase in the number and size of the bloodvessel channels, a distinctly innocent growth, or, in a few rarer cases, to an innocent hypertrophy of the connective tissue about the bloodvessels, a tumor which may be described as an elephantoid hæmangioma.

Clinically the innocent hypertrophy of the congenital or acquired hæmangioma is easy to recognize. When it is due to enlargement of the bloodvessel spaces, change in the size of the tumor and compressibility are almost pathognomonic signs. The epidermis seldom, if ever, ulcerates. In the rare cases when the hypertrophy is due to increase of fibrous connective tissue about the bloodvessel the tumor may lose its compressibility, but in contrast to the malignant tumor this innocent one is of very slow growth, years instead of months elapsing, and, in our observation, the skin remains intact and the tumor circumscribed.

As mentioned before, we have observed four cases of hæmangioma in which there was no positive history of a congenital tumor. In one instance the cystic tumor was situated between the skin and mucous membrane of the cheek in a female aged fifty-four years. The tumor had grown slowly for seven years after its first appearance as a small subcutaneous nodule. It proved to be a blood cyst with a definite encapsulated wall of 5 mm. in thickness. Lining the connective tissue of the capsule there was a zone of friable, hemorrhagic, spongy tissue. Under the microscope this tissue was composed of a network of vessels with thin walls, between which there was a fibrospindle and round-cell stroma. Clinically a benign tumor, histologically the tissue about the bloodvessels was more fibrous and less cellular than in the malignant tumor. The patient has been lost track of since operation, and we have not the ultimate result to aid us in the diagnosis. I am inclined to think the tumor was a benign hæmangioma disintegrated by hemorrhage. In a second case, in a woman aged fifty-years, a small vascular tumor had been observed on the scalp for three years. During the last ten months it has grown more rapidly, and recently the epidermis has become slightly ulcerated, from which there was a constant but scanty hemorrhagic exudate. Histologically the tumor was a typical perithelial angiosarcoma, one in which metastasis might be expected, but as this patient has been lost track of our record is incomplete. In the third case there is no doubt as to the diagnosis. Here we have a female aged thirty-six years. Two years previously she had observed a small tumor in the skin below the jaw; it grew rapidly, the skin ulcerated, and a fungous tumor formed. Within a year the tumor was removed; a few months later a second similar nodule formed below the scar, and enlarged glands appeared in the neck. We removed the metastatic skin nodule and the glands of the

neck. Histologically both were perithelial angiosarcomata. This patient died in a few months of metastasis.

HÆMANGIOMATOUS ELEPHANTIASIS. I have just mentioned the possibility that in the acquired or congenital hæmangioma there may be a hypertrophy of the connective tissue between the bloodvessels. This cellular change increases the size of the tumor, on account of partial or complete obliteration of the lumen of the original bloodvessel; its compressibility may be lost, and also the change in size so conspicuous in angioma may disappear. The increase in size and solidity of the tumor will at first make one suspicious that he is dealing with a malignant change in a benign angioma. For this reason our first observation was recorded in the pamphlet among sarcoma of the skin and represents the fourth case in which there was no history of congenital angioma. Its rarity justifies a consideration in detail, because the recognition of its innocent character will allow a much less extensive operation. In two of our cases, had a diagnosis of sarcoma been made, amputation would have been indicated.

CASE I.¹ (Surgical No. 6072; pathological No. 1620).—This patient was a man aged forty-six years. When twenty-two years of age—twenty-four years ago—he observed a small tumor in the skin to the

FIG. 16.

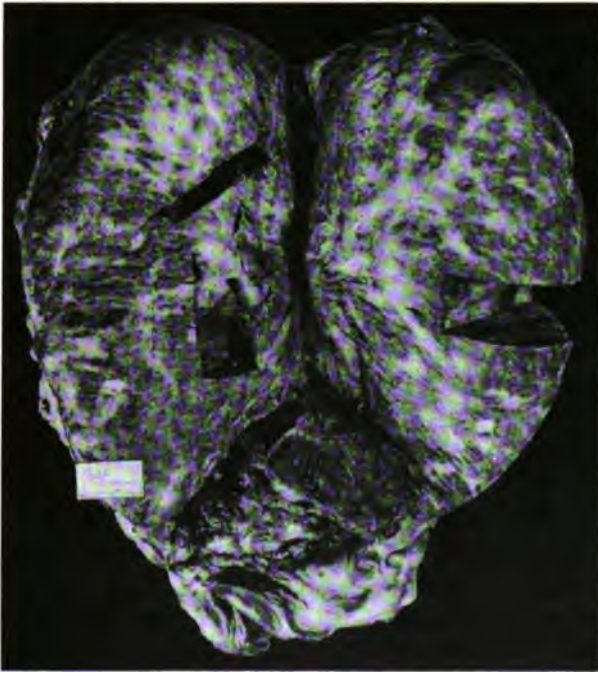


medial side of the internal malleolus. At first the growth was very slow. In ten years it has extended almost about the ankle. In the last ten years it has doubled its size. The tumor has been the constant seat of a dull pain; function had been very little restricted. The skin has remained normal. Fig. 16 illustrates the clinical appearance of the tumor. The majority of lobulations are smooth as if it had a distinct capsule; the tumor, however, in places is distinctly compressible, suggesting an angioma. When the foot is elevated for any length of time the tumor is smaller, and when the foot is lower it becomes distinctly larger and more tense. The skin is normal, slightly adherent. There is no œdema of the foot. At the operation it was found that the greater part of the tumor was encapsulated, but there were portions of the tumor having the appearance of a fine, brownish-red sponge containing blood, which infiltrated beyond the capsule around the tendon sheaths. The naked-eye appearance of this portion of the tumor suggested an angioma. It would have been impossible to completely remove the tumor without amputation. The wound was closed without drainage.

¹ Pamphlet on Sarcoma of the Skin, p. 23.

The pathological appearance of the tumor is well shown in Fig. 17. The dark areas scattered through the tumor seen in the photograph are those already described as resembling a fine sponge. From these some blood could be expressed by pressure. The white areas resembled an cedematous, rather cellular fibroma. Under the microscope the spongy area is composed of bloodvessels with thin walls. About the bloodvessels there are round and spindle cells; the latter are forming fibroblasts; there are also some lymphoid cells and lymphatic vessels; in addition there is much blood pigment in cells and between them.

FIG. 17.



In the fibrous portion of the tumor we see fewer bloodvessels, less pigment, more spindle cells and fibrous tissue, and quite a number of lymphatic vessels partially or completely plugged with proliferating endothelial cells, that is the histological picture of a fibrous and lymphatic elephantiasis.

The pathological diagnosis of a benign tumor has been confirmed by the ultimate result. Although the tumor was incompletely removed, scar tissue must have obliterated the remaining portion of the hæmangioma. At the present time, August, 1903, six years after operation, there is no evidence of recurrence.

CASE II.¹ (Surgical No. 12348 ; pathological No. 3890).—Clinically this case resembles the one just described. The patient was a white male aged thirty years. A swelling was observed on the thenar prominence of the thumb fifteen years ago, three years after a traumatism. This swelling has increased in size very slowly. Only recently has it become painful. Its surface diameters are 7 cm.; it projects above the level of the palm 3 cm. The skin is normal. The tumor is somewhat circumscribed, in areas hard, and in other spots soft and distinctly compressible. There were enlarged glands in the axilla. At the exploratory incision a tumor was exposed of similar appearance to the one just described, partly encapsulated; in other places an infiltration about the bone and tendon sheaths of the angiomatous portions; complete removal possible only by amputation. Shreds of the tumor were left adherent to the bone and tendon sheaths. The wound was closed. The gross and microscopic pathology of this tumor, which I have studied most carefully, are similar to those in the case just reported. At the present time, August, 1903, two years after operation, there is no evidence of recurrence, and the function of the hand and thumb are unimpaired.

These two cases illustrate the point that I especially wish to emphasize in this discussion, that tumors in which a positive clinical diagnosis cannot be made can, as a rule, be recognized at the exploratory operation, and, according to their nature, operations of different extents performed.

CASE III.² (Surgical dispensary ; pathological No. 4794).—I have selected this case because I believe it represents the clinical and histological picture of the two tumors just discussed at a very early stage. The patient was an adult female who had observed for three years near the external condyle of the humerus a small, freely movable tumor. Recently it has grown a little, and has become slightly painful and tender. On palpation the tumor was disk-shaped with scallop lobulations, distinctly compressible. It was excised under cocaine. The tumor sent to the laboratory was 1.5 cm. by 5 mm. in diameter. There was a distinct thin capsule of fibrous tissue. On section the entire tumor corresponded with the reddish-brown, spongy areas of the two previous tumors. On pressure blood exuded from minute canals; between these openings one could see narrow zones of whitish and brownish, firm tissue. The microscopic section showed cavities containing blood, some lined by a single layer of endothelial cells, others by proliferating masses of endothelial cells. In the stroma there were numerous round and spindle cells and fibroblasts. As the observation

¹ Pamphlet on Benign Tumors of Connective Tissue, p. 53.

² *Ibid.*, p. 52.

is a recent one, it is too early to judge of the ultimate result. I am quite convinced it is a benign tumor, and that the increase in growth was due to a beginning hypertrophy of the connective tissue between the bloodvessels.

SARCOMA IN SKIN SCARS. We have previously discussed the three cases in which a sarcoma developed in the scar after the removal of a congenital mole. In two in which the recurrent fungous tumor was a spindle-cell sarcoma the patients have remained well, but in the one in

FIG. 18.



which the recurrent tumor was an endothelioma death took place shortly after operation from internal metastasis.

Primary tumors in operative scars are rare; in scars from extensive injuries, especially burns, in which there is a long period of ulceration, they are not uncommon. As a rule, they are epitheliomata, which will be discussed later. We have observed but three cases of sarcoma to arise in the connective tissue beneath the epidermis of an old scar. In one, the scar of a burn of twenty-five years' duration, in which there was the formation of a large fungous tumor of two years' duration, the tumor was a spindle-cell and round-cell sarcoma. The

cellular areas were separated by considerable fibrous tissue. The patient died of internal metastasis in one year and six months. In a second case the tumor developed in the scar of a bullet wound; the injury had taken place thirty-two years previously, leaving a small ulcer and area of induration which never disappeared. The tumor, a pedunculated, fungous mass, had been observed three months. The scar was in the skin of the leg. Apparently the tumor was completely removed. The patient died of internal metastasis seven months later. Histologically it is a round-cell and spindle-cell sarcoma. The third

FIG. 19.



case is of particular interest. The patient was a male aged thirty-four years. Four years ago he was struck on the forehead with a lump of coal. This traumatism left a black pigmented area 1 cm. in diameter. Two years later he observed that this pigmented area was becoming elevated. The skin did not ulcerate. The tumor was removed six months ago, and immedi-

ately recurred. The recurrent tumor is well illustrated in Figs. 18 and 19. At the operation it was apparently completely excised. Histologically it is a spindle-cell and round-cell sarcoma, and in spots we can see the old coal pigment. The patient died one year later of internal metastasis.

Clinically these three cases resemble somewhat the two cases of tumors in the scar after the excision of a congenital mole, but histologically they are mixed spindle-cell and round-cell sarcoma, while the two cured cases were almost pure spindle-cell sarcoma with some fibroblasts and fibrous tissue. As we will bring out later under sarcoma of the soft parts, our observations have demonstrated that the malignancy of sarcoma increases with the number of round cells in the tumor, and decreases as the tumor is composed chiefly of spindle cells, especially if these spindle cells show a tendency to form fibroblasts and fibrous tissue. It is very difficult to differentiate the two forms clinically and from the naked-eye appearance. Both should be treated as malignant tumors, but we can make the prognosis with a good deal of certainty from the histological study.

Fibroma of the Skin. The benign prototype of sarcoma in skin scars is the fibroma. We recognize clinically three types: 1. *The multiple fibroma*, the so-called *fibroma molluscum*, in which the tumor is due to hypertrophy of the sheaths of the cutaneous nerves. It is easily recognized clinically by the numerous tumors which differ in

appearance from the congenital pigmented mole or vascular nævus. The tumors vary in size; they are covered by smooth, non-pigmented epidermis; they frequently become pedunculated; on palpation they are soft, almost like a lipoma. Now and then single tumors may reach a large size. Histologically we see a loose connective-tissue stroma containing spindle cells and round cells, the spindle cells forming fibroblasts; the stroma is frequently œdematous or myxomatous; throughout the tumor we see a collection of round cells and spindle cells, usually in columns, and, as first demonstrated by v. Recklinghausen, when a special stain is used we can see the filament of the cutaneous nerves surrounded by these columns of spindle and round cells. Now and then one of these multiple tumors becomes a malignant sarcoma. This is rare. We have observed it but once. The congenital benign tumor is also rare. We have had but three cases in the clinic. Figs. 20 and 21 illustrate well the patient and the excised tumors. In all 109 tumors were removed. This patient was observed in the clinic first ten years previously, when a boy fourteen years of age. At that

FIG. 20.



time only two or three of the larger tumors were removed. On his second admission he stated that there had been but very little growth in the individual tumors, and he observed the appearance of no new ones. 2. *Fibroma of the skin, true keloid* (four observations). This tumor, as compared with lipoma of the skin and other benign skin tumors, like the mole and vascular nævus, is rare. The tumor is covered with smooth, thin epidermis, to which it is intimately adherent. The tumor is smooth and very hard. It usually becomes pedunculated and frequently assumes a mushroom form. It may reach a huge size. This is well illustrated in Figs. 22, 23, and 24. The tumor shown in the photograph of a girl, aged twenty-two years, was

present at birth. It has gradually reached the present size. The gross appearance of this tumor is well shown in Fig. 25. This patient has remained well five and a half years since the complete excision of the tumor. Histologically these four cases were pure fibromata.

FIG. 21.



FIG. 22.

FIG. 23.

FIG. 24.



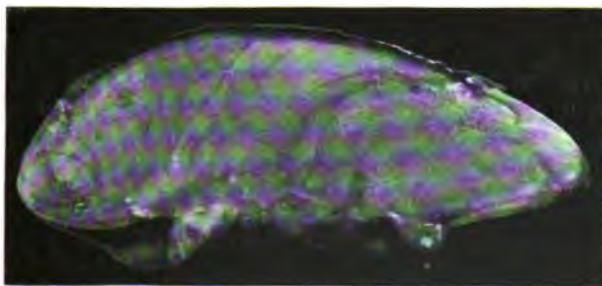
I am inclined to think that the true keloid, similar to other fibromata, has a tendency to become malignant. We have three recent observa-

tions in which the clinical appearance of the tumor corresponds to the mushroom fibroma of the scalp in Figs. 22 and 24. In all of the three cases, however, the histological appearance of the tumor had changed. Instead of a pure fibroma the growing portion of the tumor contained numerous spindle and some round cells. The change in the naked-eye appearance of the tumor is well illustrated in Fig. 26. In two of these cases, in which Fig. 26 well illustrates the naked-eye appearance, the tumors may be described as fibrospindle and round-cell fibrosarcoma. The tumor shown in the illustration had been observed in the skin on the thigh of a male, aged thirty-five years, for ten years; it had grown slowly. It had been pedunculated for five years. In the other case the tumor, situated on the chest wall of a man aged forty-two years, had been present eight years. These tumors have been too recently removed to judge of the ultimate result. At the present time (August, 1903), five months since operation, there is no evidence of local recurrence or internal metastasis. A very recent observation, however, of a tumor situated on the thigh over the trochanter, which clinically resembled exactly the tumor shown in Fig. 26, demonstrates that these tumors may be very malignant. In this case the tumor had been observed by a woman, aged forty years, for three years; it had grown slowly. There had been superficial

FIG. 25.



FIG. 26.



ulceration without fungous formation for six months, abdominal symptoms six weeks. At the operation, four weeks ago, I found the abdomen filled with blood-stained fluid and an inoperable mass of post-

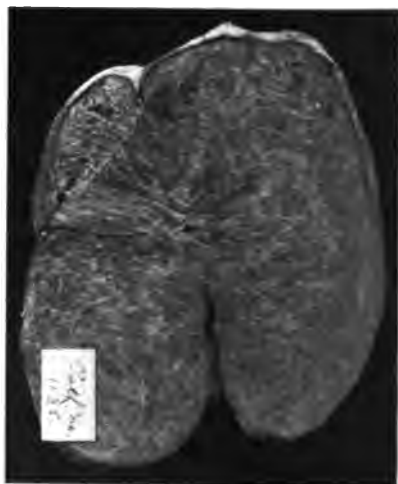
peritoneal metastatic glands. It is important, therefore, to remove at once these apparently innocent fibromata of the skin. They may remain benign for many years, or at any moment cellular changes may take place which may give rise to fatal metastases. The histological appearance of the tumor associated with abdominal metastasis differed from the two whose hosts still remain well in that round cells of various sizes and shapes predominated; there were very few spindle cells and no fibroblasts or fibrous tissue, except in small areas.

3. *Cicatricial Keloid or Fibroma of Scar Tissue.* We have observed thirteen cases. In five the keloid was situated in the scar tissue of a

FIG. 27.



FIG. 28.



burn; in two in the lobe of the ear after piercing; in two over the tendo Achillis; in scar tissue secondary to pressure ulcers from plaster bandages. In the remaining cases the keloids were situated in the linear scars of wounds which healed per primam. It is most common in the colored race. Clinically the tumor is not difficult to recognize. There is a hard, elevated, slightly lobular tumor covered with smooth, intimately adherent epidermis. Histologically the tumor is usually a pure fibroma; now and then we see spindle cells and fibroblasts. Figs. 27 and 28 are beautiful illustrations of a cicatricial keloid in the lobe of an ear. The gross and histological pictures of this tumor are identical with the fibroma just discussed and illustrated. Now and then the cicatricial keloid may ulcerate and give rise to an appearance suggest-

ive of a malignant tumor. This is well shown in Fig. 29. Clinically the tumor illustrated has been present ten years in a colored man aged sixty-four years. It grew from a traumatic ulcer over the tendo Achillis. At the operation it was found to be confined to the skin, and was removed without injury to the tendon. Histologically it contained numerous spindle cells and fibroblasts besides fibrous tissue; beneath the ulcerated surface a zone of chronic inflammation. This patient has remained well, and there has been no local recurrence five years since operation. As yet we have no definite observations of a cicatricial keloid becoming a malignant tumor. Quite frequently, especially in the colored race, a second keloid forms in the scar after the excision of the first. The growth reaches a certain size and remains stationary. In cases which I have observed in white individuals, and which have not reached sufficient size or given sufficient

FIG. 29.



discomfort to indicate excision, there is a tendency in the majority for the keloid growth to gradually disappear. In all keloid growths my observations have demonstrated that it is better to wait at least a year before excision. In the first place, at the end of this time they may show a tendency to spontaneous disappearance; if not, the probabilities of a second reformation are less than if operation is instituted earlier.

Mycosis Fungoides. Rare Tumor of the Skin. We have observed one case, and I mentioned it in the discussion of skin sarcoma because this heretofore fatal disease has recently been found to react favorably to the Roentgen ray. The clinical picture in our observation was so characteristic that Dr. Osler (the only one in the hospital who had ever observed the condition before) recognized it at once. The patient, a colored woman aged fifty-one years, was admitted to the surgical ward in the seventh month of the disease. At this time all the lesions

were present. The areas of desquamating eczema, those of infiltration of the subcutaneous tissue beneath the area of eczema and the tumor

FIG. 30.



formation, some small and still covered with epidermis, others larger with a granulating, fungous surface; also, there were areas in which the disease had been present but had disappeared, leaving scar tissue. The condition when first observed is well illustrated in Fig. 30. The patient was under observation two and a half years, until her death. The clinical picture just prior to death is illustrated in Fig. 31. It is to be noted that the lesions present chiefly on the body when first observed had almost disappeared, and those illustrated in the second photograph were not present when first admitted to the clinic. This patient died of marasmus. Unfortunately there was no autopsy.

The histological study of sections

FIG. 31.



taken from this case corresponds to those of Gebele¹ in a very recent contribution. The microscopic picture resembles closely a lymphosarcoma,

¹ Beiträge zur klin. Chirurgie, 1903, Band xxxviii. p. 530.

but there are other cellular changes which would indicate that the lesion resembles more a chronic inflammation than a tumor formation. Ziegler classifies this disease with inflammatory granulomata of the skin. Clinically the picture resembles an inflammation rather than a sarcoma. We know nothing of its etiology, except that it can no longer be considered a luetic affection, the view expressed by Albert in 1832, who first described the disease. The best résumé of the literature is Gebele.¹ Marsh,² of Troy, N. Y., reports a case of mycosis fungoides apparently cured by the X-ray. The lesions, tumor formations, were present on the back of the neck, the upper lip, and the nose. The lesions illustrated by Marsh so closely resemble a case illustrated by Gebele that it is fair to agree with Marsh's diagnosis, although no microscopic confirmation was made as in Gebele's case. In Marsh's patient the lesion on the back of the neck had been present for ten years, on the nose three years, on the upper lip six months. All the tumors disappeared after being exposed to the Roentgen ray, leaving healthy scars.

Jamieson³ reports two cases with equally good results from the X-ray. Sixty exposures were given. It is interesting to note that Marsh gave his patient sixty exposures between September 23d and December 31st.

Histologically the lesions of mycosis fungoides remind me of those recently pictured of Hodgkin's disease by Dorothy M. Reed,⁴ who has undoubtedly contributed the best pathological study of this lesion of the lymphatic glands. Reed interprets Hodgkin's disease as a chronic inflammatory lesion, and not a new-growth. It is interesting to note that the Roentgen ray has apparently accomplished cures, or at least a complete disappearance of the lymphatic tumors.

Sarcoma of the Soft Parts. In this pamphlet I have considered those malignant connective-tissue tumors originating from the subcutaneous fascia, from the fascia around and between muscles, from tendon sheaths, and sheaths of nerves. I should have also discussed here sarcoma arising from muscle cells, but we have no examples of this rare form of tumor.

The tumors situated in the connective tissue between skin and bone and not connected with any special gland or organ are in their early stages frequently difficult to differentiate from the benign connective-tissue tumors which may be present in the same locality. We must differentiate the malignant sarcoma from the benign subcutaneous lymphangioma and hæmangioma; from the various forms of fibroma

¹ Loc. cit.

² American Journal of the Medical Sciences, August, 1903, vol. cxxvi. p. 314.

³ British Journal of Dermatology, January, 1903.

⁴ Johns Hopkins Hospital Reports, vol. x. Nos. 3, 4, and 5.

and fibromyxoma of nerve sheaths and lipoma; from inflammations and tumors of lymphatic glands and from deep-seated cysts. It is seldom, if ever, difficult to recognize tumors arising from the periosteum or medullary cavity of bone.

COMPARATIVE FREQUENCY OF SARCOMA OF SOFT PARTS WITH SARCOMA IN OTHER AREAS. From the opening of the clinic in June, 1889, up to April, 1903, a period of almost fourteen years, we have observed thirty-four cases of sarcoma of the soft parts. During the same time there have been treated in the surgical clinic forty-two cases of sarcoma of the skin just discussed; forty-three cases of sarcoma of bone (not including the jaw), and forty-two cases of sarcoma of the jaw (upper and lower); thirty-four cases of sarcoma primary in the lymphatic glands (in this latter group twenty-four cases of Hodgkin's disease are not included). During the same period we have observed only six sarcomata of the parotid, one of the thyroid, and six of the breast. It is interesting to note the comparatively equal frequency of sarcoma from these different tissues.

ORIGIN OF SARCOMA OF THE SOFT PARTS. In fourteen cases the tumor originated from the fasciæ between the skin and muscle; in ten cases the sarcoma was situated intermuscularly between bundles of a single muscle or between two separate muscles; in six cases the malignant tumor originated from the sheath of a tendon; in four cases in which the tumor was inoperable we could not be positive of the origin.

DISTRIBUTION OF SARCOMA OF THE SOFT PARTS. Almost every locality of the body is represented by one to three cases. In the thigh only we have observed a larger number—six cases. In the region of the ankle, toes, wrist and hand, and penis we have no examples of this form of tumor.

PATHOLOGICAL CLASSIFICATION OF SARCOMA OF THE SOFT PARTS. After a most careful study I found that the histological character of the tumor was the best index of its malignancy, and, as a rule, it has a certain relation to the clinical history and picture. We may classify them as follows:

1. *Lymphangiosarcoma, Endothelioma* (three cases). Histologically these tumors correspond to the pigmented alveolar sarcoma arising in congenital moles, except the three tumors have not been pigmented. These tumors have been situated between the muscles, in the forearm, thigh, and leg. Clinically the patients have been aged eighteen, fifty-nine, and nine years; duration of the tumor ten years, four weeks, and seven months. In the two cases in which the tumors were of shorter duration and more rapid growth the patients died of internal metastasis within a year. The patient in whom the tumor had been present ten years in the muscles of the forearm has been lost track of. Clinically

the tumors have been fairly encapsulated, but at the pathological examination infiltration of the surrounding muscle was present. On section the tumor has a peculiar milky-white appearance; there is a gross lobulation with very fine trabeculæ; the surface of each lobule is finely granular; on pressure there exudes a whitish, granular juice; scraped with a knife the surface is very friable. The naked-eye appearance of the fresh tumor is, therefore, characteristic; it is the

FIG. 32.



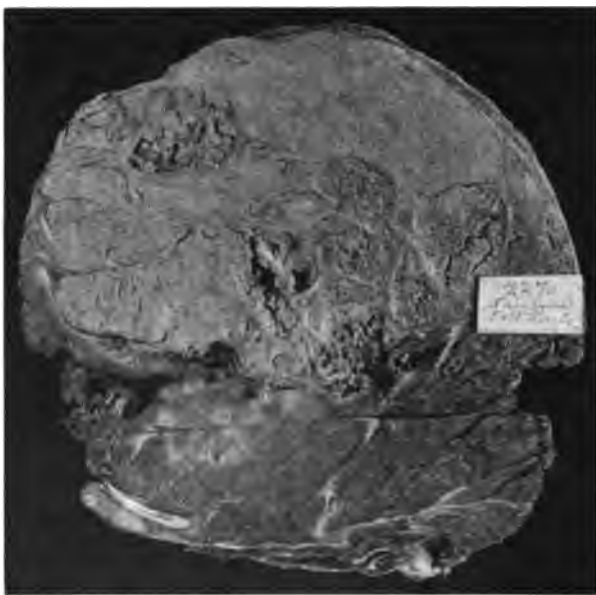
only form of sarcoma in which I have observed this milky, granular juice. Histologically the tumor is made up of tubular alveoli of various sizes, filled with cells. These cells vary in their morphology; some are lymphoid, others larger cells with a central nucleus. In the larger tubules the central cells are necrotic, and we can make out here and there a lumen. Fig. 32 is a good illustration of the naked-eye appearance of this variety of tumor. It was situated between the muscles of the leg in a girl aged nine years. Pain and swelling had

been present but seven months. During the last six weeks the growth had been rapid. On palpation the tumor was firm and elastic, the skin normal. After an exploratory incision demonstrating the malignancy of the tumor the leg was amputated. The glands in the popliteal space showed metastasis. The patient died within seven months with symptoms of internal metastasis.

We have observed no benign prototype of this deep-seated lymph-angiosarcoma.

2. *Hæmangiosarcoma* (three cases). Histologically of the perithelial variety. One case situated in the tongue, a second between the muscles

FIG. 33.



in the lumbar fossa, and a third, a recurrent tumor, between the muscles in the amputated stump of the thigh. Clinically these tumors grow rapidly, are seldom encapsulated, soft, on fresh section juicy and very hemorrhagic; when the blood is washed away from the surface they show a peculiar meshwork difficult to describe, but quite characteristic and well illustrated in Fig. 33. This patient was a female aged twenty-five years, and had observed a swelling of the left lumbar fossa for four months. The skin was not involved. Clinically it resembled somewhat a lumbar tuberculous abscess. After an exploratory incision demonstrating the malignant character of the tumor it was completely excised. The patient died within six months, of internal metastasis.

Unfortunately, the patient with the hæmangiosarcoma of the tongue died after operation. The third case has been lost track of.

The ultimate results of our seven cases of hæmangiosarcoma of the skin—three of the soft parts and four of the bone—have in each instance been fatal. Apparently dissemination takes place very rapidly. I find nothing in the literature to demonstrate that the X-ray or toxins have any effect on this form of tumor or lymphangiosarcoma. Our only hope to cure these two varieties rests upon very early recognition and complete removal. Unfortunately, as yet, none of our patients have come to the clinic in the very early stage. Only future observations will demonstrate whether there is any possibility of a cure of these two most malignant forms of sarcoma.

3. *Spindle-cell and Round-cell Sarcoma.* The other varieties of sarcoma of the soft parts show histologically various combinations of spindle and round cells. In a few cases there was an admixture of giant cells. The malignancy of the tumor varies with the number of round cells.

The benign prototype of this sarcoma is the fibroma. Studied clinically and histologically this group of benign and malignant tumors is the one most difficult to classify. We have, in the first place, a tumor clinically distinctly benign, histologically a pure fibroma, and, in the second place, a tumor from its clinical history and picture distinctly malignant, histologically a mixed spindle-cell and round-cell sarcoma. Between these two extremes we find the greatest variety of clinical pictures associated with a histological structure somewhat identical. I have a histological section of a tumor arising between the abdominal muscles which we must consider from the clinical history, picture, and ultimate result an innocent fibroma, but this microscopic section could not be differentiated from one of a tumor the clinical history, picture, and ultimate result of which place it among malignant tumors. It is in this group of tumors that the histological appearance is not always an index to its malignancy. From a theoretical standpoint the subject is of great interest; from a practical view less so. All of these tumors should be subjected to complete removal. From the literature on the X-ray treatment of tumors I am inclined to think that the best results have been obtained in the fibrospindle-cell connective-tissue tumors, and it is in this group that a preliminary X-ray treatment seems justifiable; but only in those cases in which the operative removal would necessitate the loss of the limb or some mutilating operation. If such a tumor is first subjected to a careful pathological examination, and we find that its histological structure places it among those border-line tumors in which experience has demonstrated that dissemination takes place very late, it is justifiable

to try the X-ray, provided a complete operative removal would be a mutilating operation. Coley, in his numerous reports on the results of the treatment of malignant tumors with the toxins of the streptococcus and prodigiosus, has obtained the best results in tumors which he calls spindle-cell sarcoma. A pure spindle-cell sarcoma, however, is a very rare tumor. The more carefully we study a single section and the more sections we study of a single tumor the less frequently do we find a pure spindle-cell sarcoma. Spindle cells are present in varying numbers both in the benign tumor—the fibroma, and in the malignant tumor—the sarcoma. In the benign tumor and in the less malignant sarcoma the spindle cell shows a great tendency to form fibroblasts and then fibrous tissue. The greater this tendency, the less malignant the tumor. The appearance of round cells of various forms and sizes is an indication of increasing malignancy.

This difficulty in the histological differentiation between chronic inflammatory tumors, fibromata, and fibrospindle-cell sarcoma is most thoroughly considered by Fabian¹ from the pathological laboratory in Rostock. His conclusions practically agree with my own, but the subject needs further investigation. The problems of etiology and differential diagnosis are by no means settled.

Fibroma, the Benign Connective-tissue Tumor. The true and cicatricial keloid and the fibroma molluscum we have previously discussed in connection with fibrospindle-cell sarcoma originating in skin scars.

We must differentiate clinically and pathologically fibroma situated beneath the skin from sarcoma. In the surgical clinic we have observed five cases of fibroma situated in the abdominal muscles, one case arising from the tendon sheaths, and twelve cases of fibroma or fibromyoma arising from the sheaths of nerves. These tumors clinically and from their ultimate results must be classed as innocent, although histologically they are difficult to differentiate from those classed as sarcoma.

FIBROMA OF THE ABDOMINAL MUSCLES. These tumors are frequently designated as dermoid and represent one of the most interesting groups. It is a question whether they may not be of inflammatory origin. Fabian² mentions this.

One of the patients was a male, the remaining four females. Of these in each instance the tumor formation was directly associated with pregnancy. In three cases the tumor was situated between the fat and the sheath of the rectus muscle; in two between the sheath and rectus muscle itself. In four cases the histological examination demonstrated in two a pure fibroma, in one a fibrospindle-cell fibroma,

¹ Archiv f. klin. Chirurgie, 1902, Band lxx. p. 286.

² Loc. cit.

and in the fourth almost a pure spindle-cell tumor. Four were primary tumors, one recurrent. All have remained well since operation; four cases from three to ten years; in one it is only one year and six months since operation. The primary tumors in three cases had been observed in females only six to sixteen months, in one (male) six years. In the females the induration in the abdominal wall was observed during the last months of pregnancy, in the male after a traumatism. The growth of the tumor, as a rule, is rather rapid; on palpation it is firm, somewhat encapsulated, and very hard. Four cases were distinctly encapsulated; one infiltrated the rectus muscle. In this last case it would be very difficult to differentiate the microscopic section from a fibrospindle-cell sarcoma. I am inclined to think that many of the good results with the X-ray treatment recorded in tumors called "sarcoma" of the abdominal wall belong to this variety, and as this fibrocellular new formation may be of an inflammatory nature we should expect such results, but they should not be recorded as X-ray cures of malignant tumors.

FIBROMA AND SARCOMA OF TENDON SHEATHS. Tumors attached to the tendon sheaths are comparatively rare. It is difficult clinically to differentiate the solid tumor from the cyst, the so-called ganglion. Of the seven solid tumors arising from the tendon sheaths six I have classed as sarcoma and one as fibroma. I must confess that there appears to be almost as much justification to consider all of them as innocent tumors. All except one were distinctly encapsulated, rather small tumors. All have remained well, as far as we have been able to ascertain, since operation. The tumor classed as benign had been present on the flexor tendon at the base of the little finger for twenty-five years, as a freely movable mass the size of a buckshot. Pain, tenderness, and increased growth have been observed only a few days following traumatism. The microscopic sections showed an oedematous pure fibroma with a few areas of hemorrhage and cellular areas which I thought could be explained by the recent trauma. Of the six cases classed as sarcoma the tumors had been present from two to five years in five cases and six weeks in one case. In five cases the ages of the patients varied from fifteen to thirty years; one individual was fifty years of age. Histologically one was a pure spindle-cell tumor; three were fibrospindle-cell tumors—that is, the spindle cells were forming fibroblasts and fibrous tissue; in two cases, also fibrospindle-cell tumors, there were numerous giant cells. These two observations represent the only ones in which we found giant cells in sarcoma or fibroma of the soft parts. Five of these tumors were situated on the flexor tendons of the fingers at the base; one on the flexor tendon in the plantar surface of the foot, and one on the extensor

tendon of the dorsal surface. These tumors all could be excised without injury to the tendons or function of the part. In view, however, of their histological structure they should be completely removed.

FIBROMA OF SHEATHS OF NERVES. This is comparatively a common origin. We have observed twelve cases. From a nerve in the axilla, four cases; neck, two cases; groin, one case; eleventh dorsal nerve, one case; sciatic nerve, one case; end of nerve in amputation stump, three cases. Histologically only the amputational neuromata were pure fibroma, the others were chiefly composed of myxomatous tissue, and may be called fibromyxoma. The amount of fibrous tissue, as a rule, varied with the age of the tumor. Clinically they are of slow growth, and may reach large size; they remain distinctly encapsulated; on palpation they are lobular, as a rule much softer than the pure fibroma. The softness of the tumor suggests a sarcoma, but when they appear in the clinic with the usual history of long duration and slow growth, remaining encapsulated and covered with normal movable skin, their innocent nature is manifest. If observed very early after their appearance a differential diagnosis from a sarcoma could only be made at the exploratory incision. These tumors should be completely removed, and, as a rule, this can be performed without injury to the nerve. These twelve cases have been followed, and their innocent nature confirmed by the ultimate result. One observation, however, demonstrates that the fibromyxoma of nerve sheaths may become a malignant tumor. In this, the thirteenth case, the large tumor surrounded the sciatic nerve above the popliteal space. Clinically it had grown rapidly, and at the operation it had broken through its capsule in places. To completely excise it, it was necessary to remove the sciatic nerve. Histologically this tumor differed from all the others in that there were numerous areas of round cells, varying in size and shape, mixed with myxomatous tissue. The tumor recurred locally in six months; the recurrent tumor was a pure round-cell sarcoma; amputation of the thigh was necessary. As the operation is a recent one, we are unable to state in regard to metastasis.

I have recently removed a tumor of somewhat similar character situated in the left buttock of an infant three months of age, and which, I think, may have originated from the sheath of the sciatic nerve. The swelling had been observed six weeks, and had grown rapidly without apparently interfering with the general nutrition of the child since its appearance. The baby, however, had never been robust, and was only fairly well nourished. The left buttock was quite distended with a tense tumor which on palpation gave distinct fluctuation; the skin was normal. Per rectum, a bulging of the tumor through the sacrosciatic notch could be palpated. Clinically there had

been evidence of this intrapelvic protrusion only one week. At the operation the aspirating syringe withdrew clear yellow fluid, the second aspiration bloody fluid. After dividing the skin, subcutaneous fat, and gluteus muscle there was exposed a tense, smooth, bluish membrane. On incising this a large cavity was opened containing some blood-stained fluid and a large intracystic mass covered with a thin, bluish capsule and adherent to the membranous wall of the cavity at only one area, about 1 cm. in diameter. A lobule of this mass projected into the pelvis and could easily be delivered, as it was not adherent to the capsule. At the first operation only the intracystic mass was removed, leaving the capsule for a second operation on account of the age and weakness of the baby. The intracystic mass was soft, and on section chiefly of myxomatous tissue. Soft, cellular areas, however, could easily be recognized, and the naked-eye diagnosis of a round-cell myxosarcoma was confirmed by the frozen section. This tumor differed from the previous myxosarcoma of the sciatic nerve only in its definite capsule in which the intracystic mass was surrounded by serous fluid.

This patient died a few days after operation, and the autopsy demonstrated an intrapelvic tumor of similar character, directly continuous with the one removed, but there were no metastases.

In the medullary cavity of bone myxosarcoma, originating probably from islands of cartilage, are not uncommon, and as compared with other bone tumors not very malignant. We have observed four cases.¹ Two have remained well six years and seven years after operation; one died two and a half months after operation with symptoms of lung tuberculosis which may have been metastasis. In the fourth case the tumor was inoperable on account of its infiltration from the sacrum about the spinal cord.

Myxomata resembling the fibromyxomata of nerve sheaths are the most frequent benign tumors of the breast. We have observed forty-six cases in which there is no doubt as to the innocent nature of the tumor, and four cases in which the ultimate result and histological study demonstrated that the tumor had become a myxosarcoma. The myxosarcoma is, therefore, of a low grade of malignancy. Dissemination takes place late, and we should expect cures in the majority of instances when complete excision can be performed.

There are no definite observations in the literature in regard to the effect of the Roentgen ray on myxosarcoma.

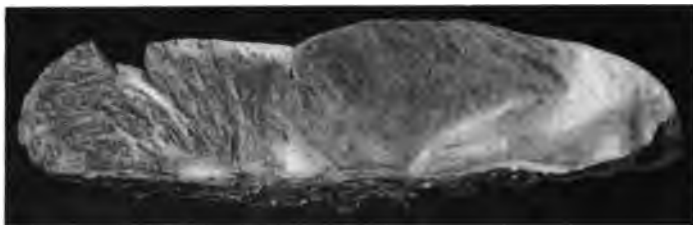
FIBROSPINDLE-CELL FIBROMA OR SARCOMA. This undoubtedly is the border-line group between the definitely innocent fibroma and the

¹ PROGRESSIVE MEDICINE, December, 1902, p. 160.

malignant sarcoma. Histologically the tumor is composed chiefly of spindle cells; some are forming fibroblasts, and the tumor contains areas of varying amounts of fibrous tissue. Histologically it is very difficult to differentiate this tumor from the fibrospindle-cell fibroma.

In two of these cases the tumor arose from the tendon sheaths; in four from the subcutaneous fascia; in one the tumor was situated between the muscles. Three cases, on account of their infiltration, may be considered clinically malignant. In the remaining cases it would be difficult from the clinical appearance of the tumor to make a diagnosis as to its malignancy. The ages of the patients varied from sixteen to fifty-three years; the primary tumors from two months to eight years; in one recurrent tumor the entire duration was twelve years, yet this patient has remained well since our operation. Six of these cases have been cured. In the one observation in which a cure did not result the huge, subcutaneous tumor of the back was inoperable on account of its infiltration into the abdomen and abdominal muscles, yet

FIG. 34.



the piece of tumor removed at the operation resembles in its growth and histological structure more a spindle-cell fibroma than a sarcoma. Fig. 34 is a good illustration of the naked-eye appearance, and should be compared with Fig. 25, a pure fibroma, and also with Fig. 26, a much more cellular tumor.

It is my opinion that future observations will demonstrate that the X-ray will yield better results in this group of sarcoma than in any other. As far as our observations go, general dissemination is a very late occurrence. The inoperability of the tumor is due to rapid growth and infiltration of surrounding parts, for example, the one just mentioned as situated in the abdominal wall. If a tumor of this character is situated on an extremity and has infiltrated sufficiently to demand an amputation for its complete removal, a preliminary X-ray treatment would be justifiable. The histological appearance of this tumor is so characteristic that from a piece removed a correct diagnosis could be made.

FIBROSPINDLE-CELL FIBROMA OR SARCOMA CONTAINING GIANT CELLS. Histologically this tumor differs from the one just discussed only in the presence of giant cells. In our two observations the small encapsulated tumors originated from the tendon sheaths of the flexors of the fingers in patients aged about forty years. In one the tumors were multiple, of eighteen months' duration; the three tumors were removed. In the other case the tumor was single. One patient has been lost track of; the other has been cured.

PURE SPINDLE-CELL FIBROMA OR SARCOMA. We have observed but two cases. In one the tumor was situated on the plantar surface of the foot; in the other, in the subcutaneous fascia beneath the skin at the inner canthus of the eye. The former tumor is well illustrated in Fig. 35. The patient was twenty-four years of age, and the tumor had been observed four years. The skin was slightly adherent, the tumor was fairly well encapsulated, but the capsule was adherent to the periosteum of the metacarpal bone. Unfortunately, this patient has been lost track of since operation. In the second case, a male, aged twenty-seven years, observed a tumor the size of buckshot five years beneath the skin of the eyelid. At the end of one year it was excised, but recurred immediately in the scar. The recurrent tumor was treated with caustics with no results. It, however, has grown very little during the past three years. The recurrent tumor was encapsulated, adherent to the skin, and about 1 cm. in diameter. There was no difficulty in completely excising it. This patient, too, unfortunately, has been lost track of. The long duration of these tumors, their slow growth and encapsulation would indicate that a pure spindle-cell sarcoma is of a low grade of malignancy.

SPINDLE-CELL AND ROUND-CELL SARCOMA. The clinical picture, history, and ultimate result in this group of tumors establish the fact of their malignancy, and the histological picture is entirely different from the fibrospindle and giant-cell tumor. Here we find for the first time that the spindle cells show little or no tendency to form fibroblasts or fibrous tissue, and there are seen in the section round cells of various sizes and shapes. The greater the number of round cells, the

FIG. 35.



more malignant the tumor. Here, also, for the first time we observe a tendency of the tumor to ulcerate and form a fungous mass. The malignancy of these tumors, however, is by no means as great as that of the hæmangiosarcoma and lymphangiosarcoma. Internal metastasis is apparently late. I find nothing in the literature to indicate that the X-ray has much influence on the round-cell sarcoma.

Spindle-cell and round-cell sarcoma falls naturally into two groups: (a) those in which spindle cells predominate, and (b) those in which round cells predominate. The former tumor is usually of slower growth; it may infiltrate; it is a firm tumor; its surface is more

FIG. 36.



granular and friable than the fibrospindle-cell sarcoma. Fig. 26 is a good illustration of the fresh appearance.¹

We have observed three tumors belonging to group *a*. In one there was local recurrence in the scar six months after the operation. The clinical appearance of this tumor is well illustrated in Fig. 36. The tumor had been observed two years in a male aged fifty-two years. It infiltrated the surrounding muscles. In the second case a tumor situated in and infiltrating into the surrounding quadriceps muscle of

¹ For clinical history of this case see p. 161.

the thigh had been observed but two months. Unfortunately, the patient died of streptococcus infection two days after the operation, and there was no autopsy. The rapid growth, however, and the infiltration of the muscle are indications of its malignancy. The infiltrating portion of the tumor contained many more round cells than its centre. The third tumor, which is illustrated in Fig. 26, has remained well five months since operation.

In group *b*; in which round cells predominate, we have eight observations. The ages of the patients varied from eighteen to seventy-five years. In five cases the duration of the tumor was less than nine months, in two cases six years, and in one case (a recurrent tumor) eighteen years. In five the tumor had ulcerated and formed a fungous growth. In all the tumor infiltrated the surrounding parts. Of the five operable cases two have remained well five and twelve years, respectively, after operation; two died of local recurrence, and one was lost track of.

The formation of a fungus by no means makes the prognosis hopeless. Fig. 37 is the photograph of a fungous tumor of eight months' duration in a white woman aged fifty-four years. This patient has remained well twelve years since amputation. The other cured case was a similar fungous tumor springing from the floor of the mouth between the tongue and the jaw, of nine months' duration.



FIG. 37.

In seven of the forty-two cases of sarcoma of the soft parts no pathological classification was possible, because the tumors were inoperable. Five were recurrent tumors, two primary. In the majority of cases operation would have been possible if the patients had sought advice earlier in the disease.

Inflammations and Tumors of Muscles. It seems appropriate to discuss, in connection with benign and malignant tumors situated between the skin and the bone, those diseases which have their origin in the muscles themselves. The clinical differential diagnosis of the various subcutaneous inflammatory, innocent, and malignant tumors is

frequently difficult and sometimes impossible. Fortunately, the naked-eye appearances of the various pathological conditions can, as a rule, be recognized at the exploratory incision. It is of the utmost importance that surgeons train themselves to recognize these differences, because on this recognition depends the nature of the operation which, when the disease is confined to an extremity, varies from a simple incision to an exarticulation at the highest joint.

Among the forty-two cases of sarcomata of the soft parts just discussed, in nine cases the tumor was situated in or between the muscles. In three cases the tumor was a lymphangiosarcoma situated between the muscles of the forearm, thigh, and calf of the leg. Clinically the tumor could not have been differentiated from a benign fibroma or a chronic myositis. The naked-eye appearance which we have illustrated is, fortunately, sufficiently characteristic to make a positive diagnosis. In one case the intermuscular tumor in the lumbar fossa was a perithelial angiosarcoma. The gross appearance of the tumor is characteristic and would allow a positive diagnosis of a very malignant sarcoma. (See Fig. 33.) The clinical appearance of this tumor, however, did not differ from that illustrated in Fig. 36, which proved to be a pure spindle-cell sarcoma. These two malignant sarcomata clinically could not have been differentiated with certainty from a tuberculous myositis of the muscles in this area, nor a benign fibroma. The remaining five cases were different forms of fibrospindle-cell sarcoma or mixed spindle-cell and round-cell sarcoma in which the same difficulty in the clinical differentiation was present.

ACUTE MYOSITIS. As previously discussed,¹ primary purulent myositis, as a rule, should be of easy clinical recognition, because the swelling of the muscle is always associated with acute local inflammatory symptoms and not infrequently with general symptoms. This possibility of a primary myositis which usually proceeds to abscess formation is not generally recognized by the profession. Its etiology and pathology are quite similar to primary purulent osteomyelitis. The disease is, without much doubt, of greater frequency than the scant literature would indicate. Ito and Sinnaka² have studied this disease most carefully in Japan, and find that it is of quite common occurrence. The clinical picture of the cases observed by them agrees with those of Honsell's and my own.³ Bacteriologically in the majority of cases the infection is due, similar to osteomyelitis, to the staphylococcus pyogenes aureus. These cases are characterized clinically by the rather rapid abscess formation. A few cases in which the staphylococcus pyogenes

¹ PROGRESSIVE MEDICINE, December, 1902, p. 171.

² Deutsche Zeitschrift f. Chirurgie, 1903, Band lxi. p. 303.

³ PROGRESSIVE MEDICINE, December, 1902, p. 171.

albus was found in pure culture exhibited clinically less local and general symptoms, and resolution took place without abscess. The streptococcus cases (*myositis streptomycotica*) run a much more acute local and general course. Locally lymphangitis of the skin cover is usually present. A few cases have been observed in which the pneumococcus, the colon bacillus, or the typhoid bacillus were demonstrated in pure culture. Clinically these cases are much less acute. Very rarely the etiological organism of myositis is the gonococcus.¹ Recently Harris and Haskell reported a single observation before the Johns Hopkins Medical Society.²

CHRONIC MYOSITIS. Clinically the chronic inflammatory swelling of single muscles are very difficult to differentiate from innocent and malignant tumors. The naked-eye appearance, however, is characteristic. We may recognize at least three forms: *myositis fibrosa*.³ In this instance the chronic inflammatory infiltration and muscle degeneration is secondary to a traumatism, or the long-continued pressure of an improperly applied plaster bandage. At the exploratory incision into the indurated muscle the diagnosis is at once made.⁴ We fail to find a diffuse, homogeneous tumor, somewhat encapsulated, as one would see in a fibroma or sarcoma, but we easily recognize between the separate muscle bundles a great increase of fibrous tissue. In the early stages it is softer and more cellular; in the later stages harder and more fibrous. *Tuberculous myositis*: The possibility of a primary myositis of tuberculous origin must be borne in mind. The literature on this subject is very scanty. I find nothing since the excellent article of Hiller⁵ in 1899 on this subject. The cases must be separated from those inflammations of the muscle secondary to a primary focus in a neighboring joint, bone, or lymphatic gland. Any muscle may be the seat of primary tuberculous myositis. Clinically the disease gives evidence of itself by the appearance of a swelling, seldom associated with pain or tenderness. If seen in the stage before abscess formation and its resultant clinical sign, fluctuation, a differential diagnosis cannot be made from a benign or malignant tumor, or some other form of chronic myositis. In Hiller's cases tuberculin was not given. The probabilities are that these cases would react, giving a clue to the probable diagnosis. In the majority of cases reported in the literature the myositis had gone on to the stage of caseation or suppuration, making the naked-eye diagnosis of no difficulty. Excellent results followed incision and drainage or partial excision, leaving the wound open to

¹ PROGRESSIVE MEDICINE, December, 1902, p. 137.

² Johns Hopkins Hospital Bulletin, March-April, 1903, vol. xiv. p. 88.

³ PROGRESSIVE MEDICINE, December, 1902, p. 167.

⁴ Ibid., p. 170.

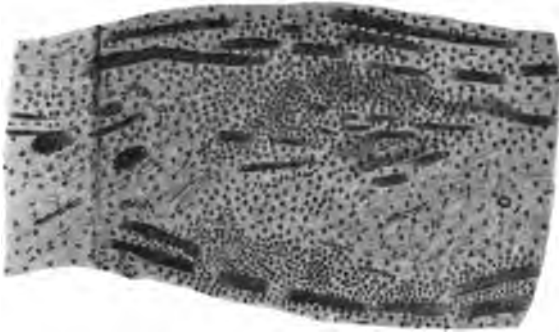
⁵ Beiträge zur klin. Chirurgie, 1899, Band xxv. p. 826.

heal by granulation. *Luetic myositis*: It is a dangerous procedure to make a clinical diagnosis of syphilis in a single chronic swelling or induration of a muscle. In the first place luetic myositis is rare, even as a multiple lesion. The single lesion cannot be differentiated clinically from the early stage of a malignant tumor. For this reason an exploratory incision is indicated in every instance. It can be easily performed under cocaine infiltration. Busse¹ gives the best recent review of the subject with excellent microscopic drawings. In the secondary stage of syphilis muscle pain and even tenderness is not uncommon. It, however, is not associated with tumor formation or induration, and disappears quickly. Pathological changes in the muscle are comparatively very rare in lues; the muscle seems to be especially resistant. The occurrence is always late and quite frequently after the other manifestations have disappeared. Luetic myositis occurs in two forms: as a multiple tumor and as a single lesion. In the former the nodule in the muscle is a typical gumma; it is usually small and freely movable; later it may become adherent to the skin and ulcerate; seen in the early stage the multiple tumors rapidly disappear under appropriate treatment. In the early stage the multiple tumors in the muscle, not infrequently associated with similar nodules in the skin, could not be differentiated from a multiple metastatic sarcoma. In the latter disease the prognosis would, of course, be hopeless. For this reason delay in treatment would be of no harm. But it is a very simple procedure to remove one of these nodules and make a positive diagnosis. This would allow us to relieve the patient of all anxiety if the tumor proved to be a gumma, and would justify immediate antisyphilitic treatment. We have observed in Dr. Halsted's clinic only four cases of multiple gumma of muscles. In each instance the diagnosis was confirmed by an exploratory incision or excision. The naked-eye appearance is quite characteristic, even in the early stage. We see the central, firm, necrotic area, which differs in appearance from the softer and caseous area of tuberculosis; about this there is a zone of infiltrated muscle; the connective tissue of this infiltration is cellular or fibrous, according to the duration of the gumma; about this there is normal muscle slightly infiltrated; between the muscle and the fibrous zone we quite frequently see minute points of hemorrhage. The naked-eye appearance, therefore, of gumma is not difficult to recognize. In the second form there is a single lesion, usually diffuse, clinically like chronic myositis fibrosa. A differential diagnosis can only be made from the microscopic examination. In the luetic myositis, according to Busse, round-cell infiltration and obliterating endarteritis

¹ Archiv f. klin. Chirurgie, 1903, Band lxxix. p. 485.

are distinguishing histological features. Fig. 38 should be compared with Fig. 51 in *PROGRESSIVE MEDICINE*, December, 1902, a microscopic study of myositis fibrosa. This chronic, luetic, diffuse myositis can be recognized at the exploratory incision. Similar to other forms of chronic myositis, excision is not necessary. Now and then the single lesion may show a gummatous degeneration.

FIG. 38.



PERIMYOSITIS CREPITANS. Pathologically this disease may be described as a chronic inflammation of the thin fasciæ covering the larger bundles of muscles and the inner surface of their aponeuroses. Clinically it is characterized by pain when the muscle is in function and a definite crepitation which can be felt and heard. On account of pain during muscular contraction function is often impaired. On examination nothing, as a rule, can be made out except the crepitation. There is seldom, if ever, enough connective-tissue hypertrophy to allow its palpation; it is not associated with muscle atrophy. It is rarely confined to a single muscle; usually a group of muscles is involved. The etiology is obscure. The diagnosis rests upon the crepitation, which must not be confused with joint crepitation. Brauer,¹ in reporting a single observation, considers a few cases in the literature. In his observation on a patient aged thirty-nine years the condition had been present in the muscles of the calf and thigh for at least three years. The crepitation was distinct. The pain on muscular contraction interfered very much with locomotion. The patient improved under rest, baths, and iodide of potassium. Massage aggravated the condition. Six months after treatment crepitation was still present, but the subjective symptoms—pain and loss of function—had almost disappeared. In Brauer's case lues and alcohol may have been indirect etiological factors. The direct cause seems to have been overexertion,

¹ Mittheilungen aus d. Grenzgeb. d. Med. und Chir., 1902, Band x. p. 758.

because the right affected limb was compelled to carry the weight of the body during a period of almost three months on account of a fracture of the lower left leg. Recently I have observed the pain, but without the crepitation, in three cases, all seated in the pectoralis major muscle, in each due to excessive and unusual exercise. In one case—in a male aged fifty years—shortly after he began to play golf for the first time; in a second case, in a woman aged sixty years, who was referred to me on account of pain with the probable diagnosis of tumor of the breast, but the local symptoms were all in the major pectoral muscle; and recently she informed me that this arm had been carrying almost constantly a rather heavy grandchild. In all of the cases rapid improvement followed rest. In the most severe instance, that of the golf player, it was necessary to fix the muscle with adhesive plasters for a week.

MYOSITIS OSSIFICANS TRAUMATICA. The recent articles by Binnie,¹ Wolter,² Borchard,³ and Taylor⁴ add nothing new to the clinical picture of this interesting disease as previously discussed.⁵

Taylor's communication is of interest, because it gives us one of the few X-ray pictures of the disease reproduced in Fig. 39. The disease in this case had been present many years in a female aged forty years. The X-ray shows not only a periosteal growth, but shadows of osteoid tissue in the muscles of the calf. The result from operation, excision of the areas of bone, was an excellent one.

One of Wolter's cases is of special interest, because it represents practically the only one which was carefully observed from the time of the traumatism. This patient, a man aged forty-four years, was admitted to the clinic twenty-four hours after a contusion to the right thigh. Two days later the diffuse swelling of the right thigh was quite large. An X-ray showed no fracture of the femur. By the fifth day there was an oblong tumor 10 cm. by 20 cm., the skin was tense, and there was definite fluctuation. Aspiration withdrew a clear, yellow, serous fluid. On the sixth day the X-ray showed a shadow denser than muscle, extending outward from the shaft of the femur. On the fourteenth day 100 c.c. of the same fluid was withdrawn, cultures sterile. During this time the patient has had no fever. At this time—the second week—on palpation definite, harder areas could be felt in the swelling. Pain and tenderness were quite marked. Unfortunately, an X-ray was not taken at this time. At the operation, about the fifth

¹ Transactions of the American Surgical Association, 1903.

² Deutsche Zeitschrift f. Chirurgie, 1902, Band lxiv. p. 318.

³ Ibid., 1903, Band lxviii. p. 17.

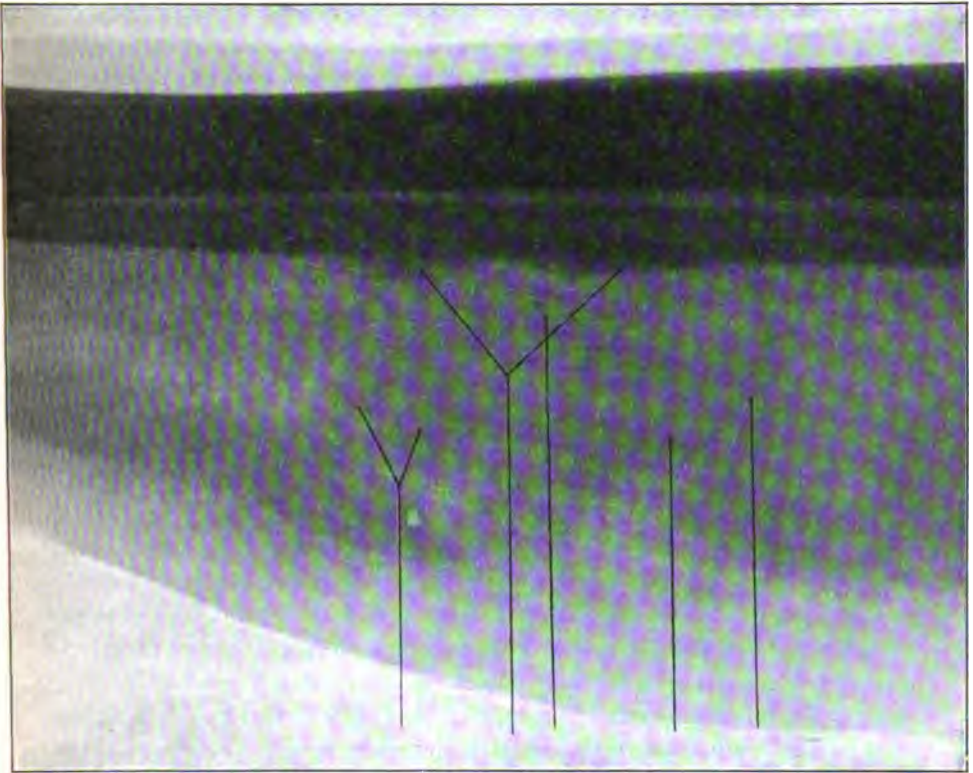
⁴ Annals of Surgery, 1903, vol xxxvii. p. 825.

⁵ PROGRESSIVE MEDICINE, December, 1902, p. 172.

week, an osteoid tumor 14 by 7 by 4 cm. was removed, in the centre of which was a cavity 9 by 5 by 2 cm. The zone of osteoid tissue was intimately connected with the periosteum and shaft of the femur. The result was an excellent one. Eight months after operation an X-ray showed only a slight irregularity of the shaft of the femur over the area from which the tumor had been removed.

Wolter gives us a very careful microscopic study of his two cases, and as in both the osteoid tissue in the muscle extended to the perios-

FIG. 39.



teum in the bone, he quite naturally concludes that it is of a periosteal origin.

Borchard's communication is by far the most comprehensive study of the literature up to date, and he concludes with great justice that it is by no means proven that the bone formation in the muscle originates from the periosteum in all of the cases. This question is of interest from a theoretical standpoint only. Practically we must bear in mind the not uncommon occurrence of an ossifying myositis following a traumatism from which any muscle may be involved. In the larger

tumors a cyst formation is quite common. Wolter believes they are of lymphatic origin. Clinically the disease should be less difficult to differentiate from a malignant tumor than the other forms of chronic myositis. The osteoid areas which form quickly, as a rule, can be palpated, and the X-ray shadow would differentiate the swelling from a benign or malignant tumor. The presence of the bone exposed at the exploratory excision would at once clinch the diagnosis.

Ossifying myositis must be distinguished from traumatic ossifying periostitis or exostoses, which will be discussed later under bone tumors. There is an interesting point here which the comparative study of the two diseases has just brought out. I find no cases of recurrence after the removal of the area of myositis ossificans, while a slight recurrence, and in some instances a recurrence equal in size to the original tumor, is the rule after the removal of the traumatic exostosis or ossifying periostitis.

BENIGN MUSCLE TUMORS. As compared with inflammations benign tumors in the muscle are relatively rare. In the sternocleidomastoid and deltoid muscles single or multiple tumors due to congenital residue of cartilage are not uncommon. These have been carefully considered by Honsell¹ and Lengemann.² Their long duration, slow growth, absence of pain or tenderness stamp them as innocent tumors. Now and then, however, they may be associated with and probably the cause of clonic and tonic spasm of the muscle. This was present in a number of cases in the sternocleidomastoid discussed by Lengemann, and the removal of the cartilage tumor relieved the muscle spasm.

INTERMUSCULAR ANGIOMA. One of the most interesting muscular tumors is the angioma. This subject has been recently fully considered by Stauch³ and Honsell.⁴ Clinically these tumors are very characteristic. Usually a diffuse swelling of slow growth, a swelling the change in the size of which is even observed by its host. On examination the tumor is usually somewhat lobular, never definitely circumscribed, doughy in consistency, always compressible. If situated in the muscles of the limb it becomes smaller with elevation, larger and tense when the extremity is lowered, especially when the veins above are constricted. The tumors are frequently quite painful. Now and then, if superficial, a bluish discoloration can be seen through the skin; in a few cases phlebolites can be palpated. Carefully studied, a clinical diagnosis should be made in the majority of instances. In Dr. Halsted's clinic we have observed three cases: one in the vastus medialis

¹ Beiträge zur klin. Chirurgie, 1899, Band xxiii. p. 210.

² Ibid., 1901, Band xxx. p. 107.

³ Deutsche Zeitschrift f. Chirurgie, 1902, Band lxii. p. 223.

⁴ Beiträge zur klin. Chirurgie, 1902, Band xxxii. p. 259.

muscle, in a male aged eighteen years, of three and a half years' duration; a second in the gastrocnemius, of fourteen years' duration, in a female aged forty-five years; and a third between the flexor muscles of the forearm, of ten years' duration, in a male aged seventeen years. In two there was no etiological factor; in one the swelling of the forearm followed a traumatism. At the exploratory incision there was no difficulty whatever in recognizing the naked-eye appearance of the vascular, spongy, angiomatous tissue, surrounded by slightly changed or normal muscle. In some cases, as described by Honsell, there may be a great increase of the fibrous tissue between the vessels of the angioma. The prognosis after excision is excellent. It is not necessary to remove all the tumor. The scar tissue will obliterate the vascular tissues left behind. For this reason one should not remove an entire muscle, but leave enough for function. I have examined our three cases from three to ten years after operation. There is no recurrence, and the function of the limb is unimpaired.

MALIGNANT TUMORS OF MUSCLE. Sarcoma originating from the voluntary muscle cell must be unusually rare. I find nothing on this subject in recent literature. The malignant tumors arise from the connective tissue around or between the muscles, and we have discussed their clinical and pathological picture. The malignant tumors cannot always be differentiated from the benign muscular or intermuscular tumors or inflammations. Fortunately the naked-eye appearances are so characteristic that one should be able to make a positive differential diagnosis and act accordingly at the exploratory incision.

TUMORS OF THE PSOAS AND INTERNAL ILIAC MUSCLE. Benign and innocent muscular and intermuscular tumors are very common in the muscles of the extremity and in the abdominal wall. They are rare, however, in certain muscles, among them the psoas and internal iliac. Tumors of these muscles have recently been considered by Jacobsthal¹ from Braun's clinic in Göttingen. He reports four cases, but finds very few in the literature, although the contributions on intra-abdominal and postperitoneal tumors are considerable. Göbell,² in his exhaustive contribution on lateral retroperitoneal tumors, mentions but one case in which the tumor originated in the psoas muscle, and none in the internal iliac. However, I think Jacobsthal may be incorrect, because in many of the cases discussed by Göbell the tumors situated in the lumbar fossa were inoperable and some of them may have arisen from these muscles.

Jacobsthal's cases are of interest in that clinically they present them-

¹ *Deutsche Zeitschrift f. Chirurgie*, 1903, Band lxviii. p. 38.

² *Ibid.*, 1901, Band lxi. p. 1.

selves as swellings in the lumbar or iliac fossa. A clinical diagnosis between a benign or malignant growth or inflammation is seldom possible. At the exploratory incision the postperitoneal tumor arising from the psoas or internal iliac muscle is exposed. In all of Jacobsthal's cases complete excision was attempted. In one, a fibrospindle-cell and round-cell sarcoma, local recurrence took place in six months; in the second, a spindle-cell and round-cell sarcoma, local recurrence took place in three months; in the third case the tumor was an innocent myxofibroma; it was 11 by 7 by 8 cm. in diameter; it was not completely encapsulated; the patient was well one year after operation. In the fourth case the tumor was a pure fibroma distinctly encapsulated and easily removed. Unfortunately, this patient died three months after operation from an untreated secondary abscess formation in the deep wound.

Göbell's¹ study of 101 lateral retroperitoneal tumors corresponds very closely with mine in that a clinical diagnosis is not always possible. The tumor exposed at the exploratory incision can be recognized by its naked-eye appearance. It is very difficult to differentiate histologically the cellular fibroma from the fibrosarcoma. There is a definite relation between the curability of the tumor and its histological architecture. Unfortunately, in Göbell's cases in many the ultimate result is not given; so his conclusions cannot be as positive as mine, in which the great majority of cases have not been lost track of.

Benign and Malignant Tumors of Bone. This important branch of general surgery receives scanty attention in American literature, and one is compelled to admit that we are somewhat behind the times in the early differential diagnosis and proper operative treatment of bone tumors. The rule most commonly followed by many surgeons—to amputate in every case of sarcoma of bone—must be considered obsolete. The question is settled without doubt that tumors of bone vary in their malignancy. In a certain group of cases the tumor can be removed by chiselling and curetting without destroying the continuity of the long pipe bone. In others resection will yield as good local results as amputation. In this group amputation is only indicated in those cases in which the local infiltration of the tumor has involved so much bone or soft parts, that a resection sufficient to completely remove the disease would leave a limb of little or no value to the individual. In the most malignant forms high amputation or exarticulation is indicated, but, unfortunately, in this group of cases internal metastasis takes place so quickly after the first local signs of the tumor that any operation, no matter how extensive, does not result in a cure.

¹ Loc. cit.

Bone tumors are comparatively so uncommon that the experience of one surgeon or even one clinic is seldom if ever sufficient to establish positive rules in diagnosis and treatment. To properly prepare one's self to fulfil all the responsibilities in the treatment of bone tumors one should constantly keep posted on the current publications of other surgeons and clinics.

In Prof. Halsted's clinic in the Johns Hopkins Hospital, from its beginning in June, 1889, up to the present time, August, 1903, there have been observed among about 15,000 surgical patients only forty-four with malignant tumors of the long pipe bones. This demonstrates the meagre experience of even a large surgical clinic, and the difficulty of instructing the medical student during his two years' sojourn in the medical clinic, because during this time one would be able to demonstrate to the student but a very few cases of bone tumors.

This was one of the reasons which led me to adopt the present system of teaching surgical pathology, which method I presented in brief before the recent meeting of the American Surgical Association.¹

The object of this system was an attempt to present in a special pamphlet on the different subjects in surgery the experience of the entire clinic. For example, in the pamphlet on malignant tumors of bone there is a general discussion on the forty-two cases which have been treated in the clinic in the past thirteen years, giving the ultimate results. In this way one is able to discuss in general, founded upon actual observation, the early clinical picture and the differential diagnosis of these bone tumors from other bone lesions. In this pamphlet the majority of the important cases which represent the different varieties of bone tumors are discussed in detail: the clinical history and examination, the operation, the description of the fresh tissue, and the microscopic section. In it the student also finds the photograph of the patient before operation, the X-ray of the lesion, and sometimes a photograph of the fresh specimen. The specimen is preserved in alcohol, and, as the student reads the clinical history in the pamphlet, he can examine the alcohol specimen, and find in the box of slides given him a stained section of the tumor in question. The ultimate result of this individual case is noted in the pamphlet. In no other way would it be possible to present to the student such a large series of bone tumors. The probabilities are that during his two years in the medical school he would observe in the wards not more than four or five cases.

The surgeon must continue his study of these rare diseases after the same method; he should adopt some system so that he has constantly

¹ American Medicine, May 30, 1903, vol. v. p. 880; Maryland Medical Journal, June, 1903, p. 230.

at hand all of his cases of bone tumors. He should keep himself familiar with the literature, so that when a new case comes under his observation he will be able to turn to his own experience and that of the literature, and give his patient the benefit of this enlarged experience.

I had the good fortune, a few weeks after I had finished the pamphlet on the forty-two cases of malignant tumors of bone, and after a careful study of the recent literature, to observe a case of bone tumor in the medullary cavity of the upper end of the tibia. On account of this special preparation I was able to recognize at once at the exploratory incision that the tumor belonged to the least malignant variety, giant-cell sarcoma, in which experience had conclusively demonstrated that a conservative operation was justifiable. The tumor, although a large one, was apparently completely removed by the chisel and curette without destroying the continuity of the tibia, and at the present time, eight months since operation, there is no evidence of local recurrence in the bone cavity, which is still open. Function of this leg is not at all impaired, and the care of the cavity, which it is my desire to keep open until the possibility of local recurrence can almost be excluded, takes very little time.¹

BENIGN BONE CYSTS. Although previously discussed,² their rarity justifies further consideration, as new cases from time to time appear in the literature. Koch,³ in reporting an observation of his own, considers the twenty-two cases which so far have been reported in the literature.

Koch's patient, observed in Körte's clinic in Berlin, was a boy aged fifteen years. He was admitted after sustaining a fracture of the femur while walking. The patient stated that this fracture was similar to one which he received in about the same place five years ago, when, after a very slight trauma, a fall, he sustained a fracture of the femur near the trochanter. At this time, after five weeks' treatment with extension and plaster, there was apparent perfect union. During these five years the boy had observed no pain or discomfort, until suddenly, while walking, he felt pain in the upper third of the femur, which suddenly gave way, and he was brought to the hospital.

At the examination the typical signs of a fracture of the femur below the trochanter were present. The swelling at the position of the fracture appeared more diffuse and the bone seemed more easy to be palpated than in a case in which the fractured bone was of normal size. This finding on palpation, associated with the history of fracture

¹ This case will be discussed later; see p. 201.

² *PROGRESSIVE MEDICINE*, December, 1899, p. 235, and December, 1902, p. 154.

³ *Archiv f. klin. Chirurgie*, 1902, Band lxxviii. p. 976.

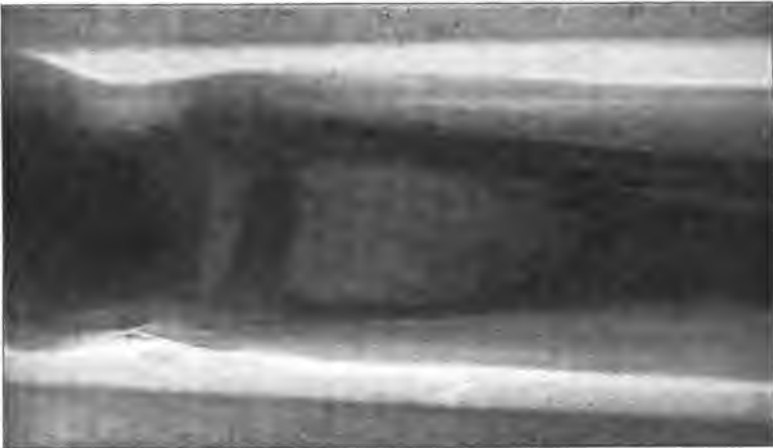
from very slight trauma, indicated the pathological origin which was confirmed by the X-ray.

During the twenty days in which operation was discussed with the parents the fracture was treated in extension. The shortening present at the examination was overcome and bony union was fairly firm. At the operation, on separating the periosteum, normal shaft was not exposed, but a new growth of bone, particles of which adhered to the periosteum as it was stripped back. Undoubtedly this new growth of bone was secondary to the traumatism. Beneath this there was a thin shell of cortical bone, then a definite connective-tissue membrane lining the cavity of a cyst, which contained bloody fluid. The cavity of the cyst began in the neck of the femur near the trochanter and extended to 6 cm. below the trochanter. The line of fracture was situated in an oblique direction through the cyst about 4 cm. below the trochanter. At the operation the continuity of the femur was not destroyed. The connective tissue lining the bony cavity was removed with a curette and the cavity packed with gauze. This cavity slowly filled, and union was solid in about six weeks. The patient left the hospital with good function and no shortening. The microscopic examination by Benda demonstrated the presence of cartilage in the wall of the cyst, confirming a view first promulgated by Virchow in 1876, that these bone cysts were due to cystic degeneration in misplaced islands of cartilage.

The clinical picture of a benign bone cyst is now pretty well established. We may expect it in any of the long pipe bones near the epiphysis, extending into the diaphyses. In some instances the first suggestion of the presence of a tumor is a fracture from very slight cause. This fracture may heal, but after union we find an expansion of bone about the site of the fracture larger than can be explained by callus, and the X-ray shows in the marrow cavity a light area which would not be present in normal bone. In other cases the patient may observe a slight expansion of a long bone near the epiphyseal end. Pain and tenderness, as a rule, are not marked symptoms. Clinically this picture cannot be differentiated from a giant-cell sarcoma. This tumor-like bone cyst produces a slight expansion of the bone. Pain and tenderness are not marked symptoms. About the cyst and the giant-cell medullary tumor there is always preserved a thin shell of bone which at any time may fracture. According to Beck, the X-ray shadow cast by the bone cyst is characteristic in that the light area in the medullary cavity is sharply outlined by the darker shadow of the shell wall of bone, and, as a rule, this light area has a smooth, roundish border. This is illustrated in Fig. 40. The X-ray in Koch's case was not sufficiently clear to make a positive diagnosis.

One could make out an oblique fracture and the light area in the medullary cavity, but the darker area of the shaft was irregular. This irregularity in Koch's case may have been due to the previous fracture. In Carson's case¹ the X-ray picture was not sufficiently characteristic to make a positive diagnosis. Helbing,² in his report of a cyst situated in the upper end of the diaphysis of the femur in a child aged five years, states that in his case the Roentgen picture did not have the characteristic shadow described by Beck, and that in other instances he has observed a shadow due to a medullary giant-cell sarcoma which could not be differentiated from the shadow cast by the benign cyst. For this reason, until further experience, we cannot be positive in our differential diagnosis from X-ray pictures. However, from the

FIG. 40.



description of the pathological appearance of the cyst one should have no difficulty in making the diagnosis at the exploratory incision. The treatment of these bone cysts is not at all difficult, and conservative operations, of course, should always be done.

According to Koch, in the majority of these twenty-two cases of bone cysts pathological examinations have demonstrated the presence of cartilage in the wall, so that the explanation of Virchow answers. In a few cases the etiology of the cysts cannot be explained in this way; for example, now and then in arthritis deformans, which is always associated with a chronic inflammation of the bone in the neighborhood of the joint, we observe cysts which are due to a softening process secondary to the bone inflammation (Ziegler). In a few instances cysts have

¹ PROGRESSIVE MEDICINE, December, 1902, p. 154.

² Centralblatt f. Chirurgie, 1902, Band xxix. p. 138.

PLATE III.

FIG. 1.



FIG. 3.



FIG. 2.



FIG. 4.



been observed in bones the seat of osteomalacia (Rindfleisch). In other cases the etiology of the cyst cannot be explained, and the disease has been called a cystic degeneration of the entire skeleton. Such observations have been recorded by Lüche, Engel, and Sonnenburg. In the observation of the latter the patient was a girl aged twelve years. Some six months previous to her admission to the surgical clinic there had been a fracture in the shaft of the humerus in the upper third, since which time there had been continuous pain and mobility. At the examination the diagnosis of ununited fracture with pseudoarthrosis was made.

At the operation it was found that the entire shaft of the humerus was occupied by a cystic cavity containing a bloody fluid; no cartilage could be found in the wall. The etiology of these cysts is yet unexplained.

It was my good fortune after writing the above to observe a bone cyst in the upper third of the humerus in a girl aged seven years. The clinical history is characteristic. One year ago the child had a slight fall on the right arm, and sustained a fracture in the upper third. It was treated in the ordinary way. The father informs us that the swelling at the site of fracture never disappeared. The child complained of no pain or tenderness, and continued to use the arm. Three days ago, after a second slight fall, the patient refused to use this arm, and when any attempt was made at moving it she complained of pain. The swelling was apparently no larger. On examination, well shown in the X-ray picture, Plate III., Fig. 1, there is a swelling pretty well confined to the upper third of the humerus; it begins at about the surgical neck and extends to the junction of the middle and upper third. There is no infiltration of the soft parts. The palpating finger demonstrates that the swelling is an abrupt expansion of the outer table of the humerus. This bone capsule is not smooth, but has fine irregularities. In some spots it is softer than others, and these softer spots apparently are composed of pieces of bone slightly movable on each other, giving a slight crepitation. There is also slight mobility of the shaft about the centre of the expansion with definite crepitus, indicating a fresh fracture. From the history and examination the probabilities were that the tumor was a cyst. In my own experience all malignant tumors of bone in individuals under twenty are of very rapid growth, and kill by internal metastasis within a year. The only sarcoma which produces a uniform expansion—the giant-cell tumor—is very rare in individuals under twenty. For this reason I made a clinical diagnosis of benign cyst. On account of the great rarity of the disease and the importance of the diagnosis I reproduce the X-ray picture (see Plate III., Fig. 41).

This Roentgen photograph demonstrates the correctness of Helbing's statement,¹ that the shadow of a bone cyst is not always uniform and regular as seen in Beck's case. In this observation of my own only the upper and lower end of the shadow of the cyst in the medullary cavity is perfectly smooth. The irregularities in the other parts are due to the varying thickness of the bone shell. The fracture is easily made out. At the operation there was no infiltration of the tissues outside of the periosteum. The shell of bone was exposed beneath the deltoid muscle; it varied in thickness from 1 mm. to 4 mm. On removing the shell there was no connective-tissue membrane lining the bone cavity that we observe in cysts due to softening of previously solid cartilaginous tumors. The cavity was filled with blood. The wall of the cyst was composed of an expanded and very much atrophied cortical layer of the shaft of the humerus. The appearance of the bone was that seen associated with any disease producing expansion. The cyst ended abruptly in the medullary cavity below and about at the surgical neck above. The naked-eye appearance of this cyst, therefore, corresponds to the case reported by Sonnenburg, and apparently belongs to that variety of cysts called cystic degeneration of the entire skeleton, the etiology of which is not yet explained.

It is interesting to note that the general condition of this child suggested a malignant tumor. She had never been robust, and was poorly developed and anæmic (hæmoglobin 50 per cent.). Whether marked anæmia is an etiological factor in the formation of these cysts is yet to be demonstrated. There was no history or evidence of lues.

BENIGN TUMORS: OSTEOMA AND EXOSTOSIS. The terms exostosis, osteoma, and osteophyte are frequently used to designate the same tumor projecting from a bone. Usually the exostoses are congenital tumors and multiple. They are situated most frequently near the epiphyseal line. In early life they are composed of cartilage similar to the epiphysis. During the period of growth they become ossified; a thin covering capsule of cartilage will be preserved, and now and then a bursa develops over the tumor. These congenital multiple irregular growths from the skeleton, as a rule, do not give symptoms until the so-called period of growth; that is, when the epiphyses are becoming ossified. Quite frequently the extensive growth is secondary to a traumatism. In some instances the tumor is due chiefly to changes in the bursa and not in the exostoses; the bursa becomes distended with fluid and loose cartilaginous bodies develop in the bursa.

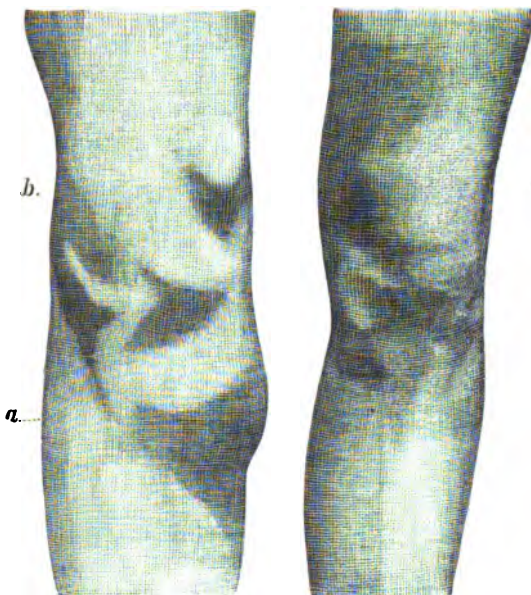
Clinically these tumors are not difficult to recognize, because of their position as a definite localized growth occupying but a small area near

¹ Loc. cit.

the epiphysis, their slow growth, and, as a rule, the absence of pain and tenderness. Now and then, however, following a traumatism the growth may be rapid, and rather large tumors may develop; pain and tenderness may be prominent symptoms. In these cases the possibility of a malignant periosteal sarcoma must be considered. The differential diagnosis can be made with certainty only from an X-ray study or an exploratory incision.

The relation between the appearance of multiple exostoses during the period of growth and coincident with the arrest of development and deformities of the skeleton has been fully considered by Grosse.¹ In these cases, however, the multiple tumors make a differential diagnosis simple.

FIG. 41.



The more important cases are those in which there is but a single tumor, which has been observed to develop rapidly with pain and tenderness after a traumatism.

Riethus² reports the following interesting case: A boy, aged sixteen years, received a contusion of the right knee. The usual pain, tenderness, and slight swelling associated with this injury was present for a few days, but there was no loss of function. The patient observed the rather rapid formation of a tumor over the internal lateral side of

¹ *Revue de Orthop.*, 1899, No. 6.

² *Beiträge zur klin. Chirurgie*, 1903, Band xxxvii. p. 639.

the head of the tibia. With the formation of this tumor there was some pain and tenderness, but practically no restriction of motion in the knee-joint. At the examination, about four weeks after the injury, the clinical picture is well illustrated in Fig. 41. On palpation the tumor was irregular and gave the sensation of fluctuation. In addition loose and fixed bodies of different sizes could be made out. The skin over the tumor was normal; there was no œdema or signs of inflammation, and it was fixed to the head of the bone. The presence of the sensation of fluid and palpation of the loose bodies would almost exclude a malignant periosteal tumor. There is no bursa in this position; for this reason one would suspect the tumor was due to the distention of a bursa filled with loose bodies over a congenital exostosis.

FIG. 42.



The diagnosis in this case was confirmed by the palpation of another exostosis on the inner side of the epiphysis of the lower end of the femur, shown in *b*. This diagnosis was confirmed by the X-ray picture (see Fig. 42). About the exostosis on the tibia we can see the shadow of the cystic tumor and the irregular shadows of the loose bodies. At the exploratory incision the diagnosis was again confirmed and the cystic tumor with the exostosis was removed. The gross pathology is beautifully illustrated in Plate IV. With this illustration a description is not necessary. The white bodies, on microscopic examination, are found to be composed of

hyaline cartilage. This observation of Riethus is a very rare one, but demonstrates the fact that following the traumatism the bursa over the exostosis may be the chief cause of the tumor, and that now and then in addition to fluid loose bodies may develop.

Riethus, in his microscopic study, concludes that the origin of these cartilaginous loose bodies is from the hyaline cartilage covering the exostosis. Therefore, an etiology similar to that of the formation of loose bodies in the joint.¹

I have never observed a case similar to this one of Riethus, and there are but few reported in the literature.

TRAUMATIC EXOSTOSES. We must bear in mind the possibility that now and then after injury to the shaft of the long bone there may be a rapid formation of new bone, which on account of pain and tenderness and rapid growth will simulate a tumor. Schuler² considers in

¹ PROGRESSIVE MEDICINE, December, 1899, p. 202.

² Beiträge zur klin. Chirurgie, 1902, Band xxxiii. p. 556

PLATE IV.



great detail five cases which have been observed in von Brun's clinic in Tübingen. In all of these cases the clinical picture is somewhat characteristic. There was a traumatism to the bone, which at first, except in one case, did not prevent the patient from walking. Very quickly, in a few weeks, in other instances a little later, the patient observes the formation of rapid swelling, which is associated with pain and tenderness. In cases in which the disease is observed longer the swelling reaches a certain size and then remains stationary, and there is no further pain and tenderness. Now and then after this period of rest if there is another trauma the tumor may grow a little and give some discomfort. This observation that the exostosis tends to reach a certain size and then stop growing is an important point in differential diagnosis. All the cases were young individuals. One case was admitted to the clinic some time after the tumor had ceased to grow, and this individual was not subjected to operation. In the other four cases the exostosis was removed by a chisel.

On examination it is practically impossible to make a positive differential diagnosis from a malignant periosteal sarcoma, especially if the patient seeks advice shortly after the appearance of the rapidly growing and painful tumor. We feel about or on one side of the shaft of the long bone near the epiphysis, or some distance from it, an irregular, hard tumor which feels like bone. A positive diagnosis can only be made by the use of the X-ray or an exploratory incision. The shadow of the traumatic exostosis as cast by the X-ray is well illustrated in Plate III., Fig. 2.

We can see from this illustration a large, irregular, periosteal growth of bone which casts a shadow whose architecture is somewhat like that of the shaft. We know that in tuberculous and pyogenic osteomyelitis, especially in the latter if chronic, there is a new growth of bone beneath the periosteum due to the irritation of the neighboring inflammatory process. This new growth of bone, however, usually encircles the shaft and is seldom if ever as extensive as that shown in the illustration. In addition, we would be able to see the change in the shaft of the bone due to the destruction by the inflammatory process. The shadow cast by the periosteal osteosarcoma differs in its architecture from that of normal bone, at least, judging from the gross pathology of this tumor and from the X-ray picture that I have had made from two alcohol specimens. I feel quite positive that the X-ray shadow of the periosteal osteosarcoma will differ from a traumatic exostosis, as shown by Schuler. In the periosteal osteosarcoma the bone is present in small spicules arranged somewhat like rays perpendicular to the shaft of the bone, so that in the X-ray shadow we would probably see this arrangement, which is not present in the exostosis. I am unable

to find in the literature a good illustration of the X-ray shadow of periosteal osteosarcoma. For this reason, to demonstrate my point, I select one of my own taken from an alcohol specimen of a tumor of this character surrounding the shaft of the lower jaw, which I am quite convinced will answer for the picture of periosteal osteosarcoma on any bone (see Plate III., Fig. 3). In all other periosteal sarcomata the new bone formation is absent or is so slight that the X-ray shadow, of course, will be entirely different from the exostosis or the periosteal osteosarcoma. In syphilitic periostitis which is quite frequently secondary to trauma, it is not uncommon to observe new bone formation. The shadow cast by it is quite similar to that shown in Schuler's X-ray, except in luetic periostitis the new bone usually surrounds the shaft, and we see its shadow on both sides, while in traumatic exostosis, in the cases at least observed by Schuler, the new bone formation is localized to one side. We must also bear in mind the possibility of myositis ossificans. As we have previously discussed, this new bone formation in some cases is adherent to the periosteum; in others there is a light zone between the shadow cast by the new bone in the muscle and the shaft. In the latter the diagnosis would not be difficult; in the former we could not make a positive differential diagnosis until after the exploratory incision had demonstrated new bone formation between the muscle bundles. In Schuler's cases the operation demonstrated that the new bone formation in each case was beneath the periosteum and the muscles were neither infiltrated nor adherent.

The clinical history of Schuler's case, illustrated in Plate III., Fig. 2, is as follows: The patient, a man aged twenty-three years, was kicked on the thigh by a horse. In addition to the contusion there was a small lacerated wound which was sutured. He was confined to his bed fourteen days on account of the injury. On getting up he complained of pain in the thigh after great exertion. Within three months after the injury he observed in the thigh beneath the area of contusion a tumor, which at first grew rapidly, then remained stationary with the disappearance of pain and tenderness. At the end of about a year, after a second slight traumatism the pain and tenderness returned, and the patient thought he observed some growth. This was present for a few months and then disappeared. This patient was observed in the clinic about one year and six months after the injury, and the X-ray shows the character and extent of the exostosis. He refused operation. However, the long duration of the tumor (one year and six months), combined with a quite characteristic X-ray shadow, was sufficient to exclude positively a malignant tumor. This patient was observed about one year later, and the examination and the X-ray

taken at that time demonstrated that the exostosis had apparently not increased in size, and was giving little discomfort.

The ultimate results in four of Schuler's cases demonstrate that, as a rule, after the excision of the exostosis there will be a slight recurrence of the disease, never, however, sufficient to indicate a second operation. This was present to a slight degree in two cases. In the remaining two cases the recurrent periosteal growth of bone was considerable.

Plate III., Fig. 4, is an X-ray of the femur three years and eight months after operation. One can see on the external lateral surface of the femur a smooth growth of bone casting a shadow slightly darker than the normal shaft. The tumor was easily palpable, but gave no pain or discomfort, and there was no restriction of function of the limb. The observation that recurrence quite frequently takes place after removal of these traumatic exostoses gives the key to proper treatment. If the patient seeks advice after the tumor has been present one year or more, and gives the history that it has ceased growing and causes no pain or discomfort, and when the X-ray photograph excludes positively a malignant tumor, there is no indication for operation. However, when we see the disease in its early stages during the rapid growth, pain and tenderness, an operation is indicated, in the first place, to positively exclude a beginning periosteal sarcoma, and, in the second place, to relieve the symptoms. But we should explain to the patient that there will be a slight recurrence of the tumor.

These observations of Schuler impress me as having unusual importance in the differential diagnosis of periosteal growths. Similar to periosteal tumors they are uncommon. There are not sufficient X-ray studies of the periosteal osteosarcoma to allow one as yet to state with any positiveness that a differential diagnosis can be made between the malignant tumor and the exostosis in the early stages, and for this reason at the present time I would urge exploratory incision. The naked-eye appearance of the exostosis showing normal bone with an outer table of compact bone, and the inner portion of bone showing a tendency to assume architecture like cancellous bone, and the presence of normal marrow tissue between the bone lamellæ will at once differentiate the exostosis from the periosteal osteosarcoma.

MALIGNANT TUMORS OF BONE. In the study of forty-four cases previously mentioned, I became impressed with a number of interesting facts of great aid in clinical diagnosis. In individuals under twenty years all of our bone tumors belonged to the most malignant varieties, and the patients died within a year of internal metastasis, although in the majority of cases the limb was amputated within three months after the first local symptom. Periosteal and medullary sarcoma in the young individual has, therefore, a very much worse

prognosis—that is, the benign varieties of bone sarcoma are very uncommon under twenty years of age. The longer the duration of the tumor after six months, and especially after one year, without symptoms of internal metastasis, the better the prognosis. If a patient comes under observation with a bone tumor of over two years' duration one can almost exclude the possibility of internal metastasis.

To cure a patient suffering with one of the malignant varieties of bone sarcoma the operation should be performed very early in the disease, within a few weeks after the first appearance of local symptoms. It is this fact that makes the responsibility of the surgeon so great. Every individual who seeks your advice because of local pain or tenderness referred to an area of bone, should be given the benefit of every doubt. A malignant bone sarcoma should always be considered, because in this lesion delay is fatal, while in other pathological conditions delay is less harmful. In this early stage a diagnosis seldom can be made from the clinical picture, and an X-ray photograph should always be taken from different views. Although my experience in the X-ray studies in the very early stages of bone sarcomata is limited, I am inclined to feel that the presence of the lesion will be shown in the X-ray picture, and we can exclude a periosteal or medullary bone sarcoma because of the negative Roentgen plate.

This opinion is based upon the pathological knowledge of bone tumors. A malignant periosteal growth at once produces destruction of the cortical layer of shaft of bone, so that even in the very early stages a lateral X-ray view would show an irregularity in the surface of the bone. The tumor, unless it contained bone, would cast but very little shadow. In medullary tumors there is also at once destruction of bone, and we would see the light area due to the presence of the tumor. It might be difficult in the early stages to distinguish this light area from a cyst, from an isolated island of cartilage, from an area of tuberculous or pyogenic osteomyelitis. However, in any event this change in the shadow from the normal would be sufficient to indicate an exploratory operation. This is the key to the situation: a negative X-ray picture, providing the picture is a clear one, and taken from at least two views, would justify one in not making an exploratory incision. On the other hand, in the presence of local symptoms, pain and tenderness, with or without swelling, associated with an X-ray negative showing a shadow different from the normal bone, would justify an exploratory incision. Fortunately, the naked-eye changes in the different pathological lesions of periosteal or medullary tumors or inflammations are sufficiently clear in the great majority of instances to allow a positive diagnosis. So that when the X-ray indicates an exploratory operation one is able to distinguish a benign

from a malignant lesion, and govern the operative intervention accordingly.

I am quite convinced that both physicians and surgeons are not sufficiently acute in their study of bone diseases in the early stage; they are not sufficiently impressed that local pain and tenderness without swelling are dangerous signs. As a rule, when patients seek advice on account of these symptoms within a few days or weeks after their appearance the average surgeon or physician waits for future symptoms. It is for this reason that malignant bone tumors are seldom subjected to operative interference at the period of the disease in which a cure may be possible.

The local symptoms, pain and tenderness, are, unfortunately, common to all bone lesions. We can only be quite certain that these symptoms observed by an individual in a small area of bone indicate some pathological lesion. After a traumatism to a bone local pain and tenderness are always present for a short time, but if these symptoms do not disappear within two or three weeks one should be suspicious of a lesion being present which cannot be explained by the results of traumatism only.

When the malignant bone tumor has reached a considerable size diagnosis is not difficult; but, as stated before, in order to cure a very malignant case or to remove the less malignant tumors without destroying the continuity of the bone, it is imperative that the lesion should be recognized very early in the disease.

I have recently observed two patients in which the local symptoms, pain and tenderness, made me suspicious of a medullary sarcoma, but in which, fortunately, the X-ray pictures demonstrated a normal bone. In one the patient was a woman aged about forty years, passing through the menopause. Eight months ago she had an attack of palpitation of the heart, lasting a few days. After this she suffered considerably with pain and tenderness referred to all the large joints in the body, but with no swelling. This gradually disappeared except at the wrist, and for the last two months she has observed a small area over the head of the lower end of the radius which is constantly tender and painful on forced flexion and radial abduction of the hand. As I had observed three cases of giant-cell medullary sarcoma situated in the lower end of the radius, in all of which previous to the appearance of the tumor there had been local pain and tenderness of some weeks to months' duration, I felt that it was imperative to exclude this possibility. Nothing could be made out on examination except, perhaps, a little fulness in the snuff-box. An X-ray picture was made of both wrist-joints, and a most careful examination demonstrates no difference in the bone shadow between the affected and non-affected radius.

Having excluded, at least as far as knowledge will allow, the possibility of a medullary sarcoma, the probabilities are that we are dealing with some form of chronic arthritis, and the negative X-ray justifies delay in an exploratory operation. The second observation was that of a physician who for some months had experienced pain and tenderness in the upper end of the humerus about the attachment of the pectoralis major muscle. There had been a history of a slight traumatism. The examination was practically negative except on palpation; the elevation of bone to which this muscle is attached appeared slightly larger than the opposite one. Here, also, the X-ray picture was negative. Following this systematic examination, I am quite certain that the time is not far distant when the X-ray will show an early malignant sarcoma.

GIANT-CELL SARCOMA. The relation of the different varieties of medullary and periosteal sarcoma to their curability has been previously discussed.¹ The most malignant variety is the perithelial angiosarcoma (four cases; three died within one year of internal metastasis and one lived two years and six months). The next in malignancy is the round-cell and spindle-cell sarcoma with little or no bone formation (six medullary and three periosteal). Eight of these cases died of internal metastasis within one year; one patient is still living, three years after operation. In this instance the tumor was so disintegrated with hemorrhage that it was difficult to establish the exact cellular pathology of the tumor. Since my note in *PROGRESSIVE MEDICINE* further sections of the tumor have been studied and it apparently belongs to the giant-cell variety. If we exclude this case we find in our twelve cases of perithelial angiosarcoma or spindle-cell and round-cell sarcoma, in which there is little or no bone formation and much bone destruction, that all the patients have died of internal metastasis within one year and a half, except in one, who lived about two and a half years.

The results in the other variety of bone sarcoma are much more satisfactory. Three cases of periosteal osteosarcoma characterized by much new bone formation are apparently cured. There are four observations of medullary myxochondrosarcoma; three have remained well, one died two and a half months after operation from tuberculosis of the lungs; so that we have not a definite observation showing internal metastasis associated with a typical periosteal osteosarcoma or medullary myxochondrosarcoma.

The giant-cell medullary or periosteal sarcoma as far as our own observations go is apparently one of the least malignant. This is confirmed by the experience of others. I recently reported the ultimate

¹ *PROGRESSIVE MEDICINE*, December, 1902, p. 159.

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PLATE V.

FIG. 1.



FIG. 2.



results¹ in eight cases of giant-cell sarcoma—three periosteal and five medullary. Six cases have remained well from five to ten years after operation; one is a more recent case in which it is but one year since the tumor was curetted from the upper end of the tibia. One patient died eight months after operation with symptoms of Bright's disease, with no evidence of internal metastasis or local recurrence; so that we have no evidence that this tumor tends to give internal metastasis. It is one in which conservative operations are justifiable, and the extent of this operation depends upon the amount of bone destruction due to the tumor. The following case represents the characteristic clinical and pathological appearance of this most important bone tumor:

The patient was a white male aged twenty-nine years. There had been a contusion of the upper end of the tibia nine months previously. At the time of the injury there were very slight symptoms: local pain and tenderness, very little swelling, no joint effusion, and no restriction of joint motion. However, ever since this date the patient has been conscious of a sensation of discomfort in the upper end of the tibia, increased after unusual exertion; it is quite tender after slight contusions; swelling, however, was not noticed until two and a half years ago. The swelling has been very gradual, and associated with it the local pain and tenderness has increased. On examination one can see a slight uniform and pretty symmetrical expansion of the upper end of the tibia. It is most marked on the anterior and medial lateral surface of the bone, which is not covered by muscle. On palpation the expanded bone is rougher than the normal shaft beneath; it feels hard, however, and is not compressible; there is no pulsation. This uniform expansion of the outer table of bone is associated usually with only two diseases: a cyst and a giant-cell sarcoma. The absence of any infiltration of the soft parts and the long duration practically exclude a very malignant medullary tumor, tuberculosis, or pyogenic osteomyelitis. The shadow cast by the X-ray is well shown in Plate V., Fig. 1, an anterior posterior view, and Plate V., Fig. 2, a lateral view. The shadow is best seen in the anterior posterior view. When we compare this picture with those already reproduced of bone cyst we can say that a positive differential diagnosis could not be made. It has irregularities, however, that are more commonly observed in the giant-cell sarcoma than in the bone cyst. At the operation as soon as the thin shell of bone was divided there was exposed a very hemorrhagic, soft, rather friable tumor, which filled the entire upper end of the tibia and was surrounded by a shell of bone of varying thickness. This is the typical appearance of a giant-cell sarcoma. There was no difficulty in

¹ Johns Hopkins Hospital Bulletin, May, 1903, vol. xiv. p. 133.

removing the soft tumor from the bone capsule. The tumor contained not a particle of bone; there was no connective-tissue capsule between the tumor and the shell of bone. In the shell of bone there were some recesses containing tumor tissue; the surface of the bony wall was very irregular and was curetted. In view of the nature of the tumor and our experience with the seven other cases of giant-cell sarcoma and the observations in the literature, it was considered justifiable to attempt to cure by this conservative operation only. The operation was performed on December 4, 1902, and at the present time, December, 1903, one year, the wound is almost filled with granulation tissue and there is no evidence of local recurrence. On three occasions pieces of granulation tissue filling the bone cavity have been removed for microscopic study and none have shown tumor cells. The microscopic examination of this tumor demonstrated that it was composed of very vascular tissue filled with huge giant cells. In Plate VI. are views of the cavity four weeks after operation. The histology of this tumor will be discussed later. The clinical history, picture, and X-ray photograph of this medullary tumor is similar to the four other cases of medullary giant-cell sarcoma. In three the tumor occupied the lower end of the radius; the patients were twenty-six, twenty-eight, and forty-five years of age. The tumor three and seven months and two years and four months' duration. In the two cases of shorter duration local pain and tenderness, and later an expansion followed a traumatism. In the case of longer duration the tumor was secondary to a Colles fracture. In all these three cases there was a uniform expansion at the lower end of the radius; one pulsated. In this case the shell of bone was very thin and in places entirely destroyed. The naked-eye appearance and microscopic sections of these three tumors corresponded in every detail to the one just described in the upper end of the tibia. In all of the cases amputation of the arm was performed. The patients have remained well five, six, and eight years since the operation. In two of the cases in which the medullary tumor was entirely surrounded by the expanded shell of bone, and in which there was absolutely no infiltration of the surrounding soft parts, I am quite convinced that an equally good result could have been accomplished by a resection of the lower end of the radius, which operation would have left a pretty useful hand. In the third case, on account of the infiltration of the soft parts and the involvement of the tendon sheath, amputation was indicated.

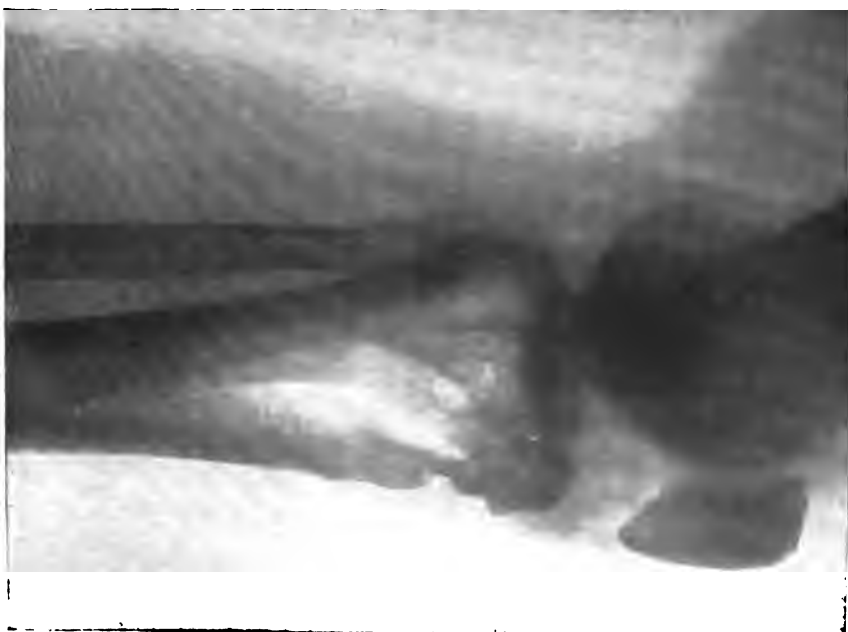
In the other observation the tumor was situated in the lower end of the femur. It is of interest clinically from the fact that the symptoms of onset were referred to the knee-joint. For seven months the patient had complained of pain and weakness referred to the left knee; swelling had been present but one month. At that time the clinical

FIG. 1.



PLATE VI.

FIG. 2.



diagnosis was made of arthritis with effusion, and the exploratory arthrotomy demonstrated an injected synovial membrane in a joint distended with clear fluid. This case was observed before the advent of the X-ray. Later, on account of further growth, the presence of a tumor was suspected in the lower end of the femur, and an exploratory incision demonstrated that the medullary cavity of the condyle was filled with a soft, hemorrhagic giant-cell tumor that had broken through the articular cartilage into the joint, necessitating amputation. The patient was under observation two and a half months before this operation. He died eight months later with symptoms of Bright's disease, and no positive evidence of internal metastasis. This case represents the only one from the eight cases of giant-cell sarcoma which has not remained well since operation.

The three cases of periosteal giant-cell sarcoma fortunately have quite a characteristic clinical picture. In one the tumor surrounded the lower third of the ulna, which had been present one year; the tumor pulsated; it was about the size of an egg, covered in the majority of places by unbroken periosteum; at one or two spots it infiltrated the muscle; it had produced a slight destruction of the shaft of the ulna. It was completely excised by resection, and the patient has remained well ten years after operation with a pretty useful arm.

In two cases the periosteal tumor grew from the tibia near the tubercle. One is of special importance, because it demonstrates the possibility of a cure by a conservative operation. The patient, a man aged thirty-five years, complained of localized pain referred to the head of the tibia for fourteen months. No swelling was observed for eight months. At this time he felt a small tumor near the bone of about the size of a pea. It soon reached the size of a hickory-nut, and at this time was removed. Local recurrence took place at once. The recurrent tumor was at least 9×3 cm., was adherent to the bone, but covered by normal skin. It had produced but slight destruction of the shaft of the tibia and was completely removed without destroying the continuity of this bone. This patient has remained well seven years since operation. In the other case the history was practically the same: pain and tenderness two years, tumor one year, operation, local recurrence. The recurrent tumor had ulcerated, and a fungous mass 3×3 cm. projected beyond the skin and was adherent to the bone. If an exploratory incision had been made in this case the pathological variety of the tumor would have been recognized and the slight infiltration of the shaft of the tibia demonstrated. Unfortunately, the leg was amputated without this exploration. In the laboratory it could be easily demonstrated that the fungous tumor was circumscribed. It had produced but slight destruction of the outer table of the tibia, and

its removal by excision could have been accomplished with as great a certainty as in the previous cases.

These two cases are of interest in that they demonstrate that the danger of internal metastasis is not increased after an incomplete operation for giant-cell sarcoma, and its local recurrence. This is another factor to justify conservative operations in this variety of tumor, even when the soft parts are slightly involved, because the danger of internal metastasis is not increased by a local recurrence. The local recurrence might force one to amputate, but the patient can always be given the benefit of the doubt without running, as far as our experience teaches us, any great risk. In the periosteal giant-cell sarcoma of the ulna mentioned above, the muscles were infiltrated. This was demonstrated at the operation and by the microscopic study.

CONCLUSIONS ON TUMORS, INNOCENT AND BENIGN. Practically every benign tumor, except the lipoma, has a certain tendency to become malignant. For this reason one has everything to gain by urgently advising their removal. It is of the utmost importance to be on the lookout for congenital moles and recommend their excision. The public should be educated to the realization that the prompt removal of a tumor offers the best prognosis. The X-ray treatment of tumors should be given only by the skilled actinographer, and he should assume this responsibility only after the recommendation of a surgeon.

The present local treatment of malignant tumors should have a very limited field. No operable malignant tumor should be exposed to the Roentgen ray except in those cases in which a clinical and pathological study demonstrates that the tumor in question belongs to one of the less malignant varieties of carcinoma or sarcoma in which delay does not increase the danger of local infiltration or internal metastasis. And even tumors belonging to this class should be subjected to operation rather than the X-ray unless the operation necessary for complete removal is a mutilating one. For example, some forms of epithelioma of the skin of the eyelid, nose, or ear, or those with extensive involvement of the cheek; also, in those cases of fibrospindle-cell sarcoma and giant-cell sarcoma, in which removal would necessitate amputation of the limb. It is apparently a good plan, after the complete removal of malignant tumors in which there is a doubt as to the completeness of the operation, to expose the wound to the Roentgen ray.

It must be remembered, however, that tumors, carcinoma, and sarcoma, which apparently disappear after X-ray treatment, may return. Recurrences have already been reported. The treatment is too recent in the majority of cases to compare the results with the complete excision of similar tumors.

GENITO-URINARY DISEASES.

BY WILLIAM T. BELFIELD, M.D.

INFECTIONS.

Gonococcus. Philippet¹ describes affections of the bones and periosteum, due to the gonococcus or its toxins, as *osteitis gonorrhoeica*. The acute cases show involvement of the shafts, indicated by slight tenderness and swelling; these symptoms usually disappear in one or two weeks. In the chronic cases the epiphyses are especially often affected, and the result may be a distinct tumor formation suggesting the gumma of syphilis. Such enlargement is, however, not affected by antisyphilitic treatment nor, indeed, by any other attempt at relief.

POLYNEURITIS GONORRHOICA, first recognized by Charcot in 1887, is the subject of a thesis by Adeline.² The parts most frequently affected are the lower extremities, especially below the knees; it is marked by hyperæsthesia of the skin and tenderness upon pressure of the muscles and nerves. The trophic disturbances are usually slight, and spontaneous recovery is the rule. The lesions may appear a few days or many months after the urethral infection.

GONORRHOËAL PNEUMONIA is reported by Bressel³ to have been observed in a man, aged thirty-two years, the subject of urethral gonorrhœa. The usual symptoms and signs of croupous pneumonia were present, but the sputum and blood contained not the usual diplococcus, but the gonococcus. The identity of the organism was verified by cultures. Recovery ensued after some weeks.

SUBCUTANEOUS ABSCESES on either side of the anus containing a pure culture of the gonococcus were opened by Gershel⁴ during the course of an acute gonococcus infection of the anterior urethra.

GONORRHOËAL PERITONITIS was observed in several children by Northrop.⁵ The simulation of appendicitis was so complete that operation was made in one case. Jacobi thinks that such cases are rather frequent, and that the prognosis is usually good without operation.

¹ Gazette hebdom., No. 79, 1902.

² Thèse de Paris, 1902.

³ Münchener med. Wochenschrift, March 31, 1903.

⁴ New York Medical Record, February 7, 1903.

⁵ American Medicine, June 20, 1903.

GONORRHOEAL ARTHRITIS following ophthalmia neonatorum is reviewed by Hawthorne.¹ It was first identified by Lucas in 1885. It exists in two forms: (1) very severe and tending to suppuration, and (2) less acute, causing much pain and effusion, but no suppuration. In the latter class the joint functions are restored by curing the infection of the eye; the suppurative cases may require incision and drainage.

Ferry² exhibited a patient in whom within a month after gonococcus infection of the urethra multiple metastatic joint infections—iritis, conjunctivitis, and double dacryadenitis—developed.

Vaquez and Lanbry³ reported two cases of arthritis gonorrhoeica resulting in ankylosis. In both of these and in a third case the joint fluid was sterile, while in a fourth case of (purulent) gonorrhoeal arthritis gonococci were numerous. In one of the negative cases the granulations of serous membrane obtained by arthrotomy contained numerous gonococci—a refutation of the prevalent view that the absence of pus and of gonococci from the aspirated fluid proves the absence of these bacteria from the joint. Such cases constitute a strong argument for making incision and drainage a routine treatment in severe gonorrhoeal arthritis.

In none of the four cases was there a general (blood) leucocytosis.

Foisy⁴ reports that resection of an elbow ankylosed through gonorrhoeal infection in a girl, aged twenty-three years, showed bony union of the three bones entering into the joint.

CEREBRAL EMBOLISM and paralysis from endocarditis of gonococcus origin is reported by Heller.⁵ The patient also exhibited an exanthem, the excised skin of these spots showing the capillaries crowded with staphylococci, which were demonstrated also in the urethral discharge. Heller considers the blood infection a mixed invasion by gonococcus and staphylococcus, though no section was obtained.

A GONORRHOEAL EXANTHEM resembling urticaria was observed by Orłipski⁶ during each of three attacks of gonorrhoea in the same patient, to whom no balsams were administered. The exanthem faded in each instance when the urethral infection was cured. The patient exhibited no such skin lesions at other times.

A GONORRHOEAL PANARITIUM was observed by Meyer,⁷ the gonococci being identified by cultures.

GONORRHOEAL ABSCESES of the back were observed in a child suffering from ophthalmia neonatorum by Cassel.⁸

¹ Reports of Society for Study of Children, 1902, vol. ii.

² Soc. d'ophtalmolog. de Paris, October 14, 1902.

³ Société méd. des hôpitaux de Paris, November, 1902.

⁴ Bulletin de la société anat. de Paris, 1902, p. 824.

⁵ Berliner klin. Wochenschrift, 1903, No. 28.

⁶ Münchener med. Wochenschrift, 1903, No. 40.

⁷ Ibid.

⁸ Ibid.

LYMPHANGITIS GONORRHOICA has been carefully studied by Dreyer,¹ who concludes (1) that suppurative lymphangitis can be caused by gonococci; (2) that the gonorrhoeal virus may long persist in the lymph vessels, virulent gonococci being found in these vessels long after the infection of the genital canal has been cured.

GONOCOCCUS INFECTION OF THE EPIDIDYMI was demonstrated by the microscope in an undescended testicle which became inflamed during a urethral gonorrhoea, and was for that reason excised by Murphy.²

NON-GONORRHOEAL URETHRITIS is discussed by Johnston,³ who recognizes a urethritis from :

1. The pseudogonococcus of Heiman, which grows on the usual cultural media and produces a mild urethral discharge lasting eight to twelve days, after an incubation of two to eight days.
2. The streptococcus, producing a slight discharge for eight to ten days after an incubation of five days.
3. The staphylococcus, producing a profuse discharge after an incubation of three days.
4. Uric acid, producing a profuse discharge.
5. Toxins of various bacteria, either indigenous to the male or acquired from the female canal.

Askura⁴ found streptococci in seven of fifty male urethras examined, and staphylococci often.

Fischer⁵ collected from the literature sixty-nine cases of *gonorrhoea in male children* under puberty, and reports two additional cases. The infection, usually acquired innocently, is apt to be severe.

"Regurgitation" of pus from the prostatic urethra into the bladder was investigated by Asakura.⁶ He injected finely powdered charcoal into the deep urethra, and after an interval of ten minutes had the patient urinate into five glasses. Each glass contained particles of charcoal.

TREATMENT. Horwitz⁷ presents an elaborate, impartial, and intelligent "inquiry into the value of the irrigation method as a means of aborting and treating acute specific urethritis," which is cordially commended for the consideration of physicians who still use the potassium permanganate irrigation method. It is admitted that "the stage of decline is hastened; that the discharge is soon transformed into one

¹ Archiv f. Dermatologie u. Syph., Band lx. Heft 2.

² Boston Medical and Surgical Journal, July 9, 1903.

³ Journal of Cutaneous and Genito-urinary Diseases, 1902, p. 433.

⁴ Centralblatt f. Krankh. d. Harn. u. Sex. Org., March, 1903.

⁵ Münchener med. Wochenschrift, November 18, 1902.

⁶ Monatsber. f. Urologie, 1903, Band viii. Heft 3.

⁷ Therapeutic Gazette, March, 1903.

mucoid in character, which gradually becomes serous;" but that this condition, due to periurethral cell infiltration, tends to persist as a chronic disease. He quotes the opinions of many conservative genito-urinary specialists, who unanimously condemn the method as less efficient and more harmful than hand injections with various silver compounds. Among his conclusions are these:

The irrigation method of treatment will not abort gonorrhœa.

It will hasten the terminal stage of the disease, which is prolonged and difficult to cure.

Chronic urethritis and involvement of the deep sexual organs are common sequences.

In many instances, in order to effect a cure in the terminal stage of the disease, the irrigations must be discontinued and other methods of treatment employed.

Irrigation should not be employed in the acute stage of specific urethritis.

Irrigation of the deep urethra by means of hydrostatic pressure is injurious in the majority of cases of acute gonorrhœa, and is conducive to the development of complications.

Trikresol is recommended for the injection of paraurethral abscesses of gonorrhœal origin after an experience with four cases by Heidingsfeld.¹ A saturated solution of acetozone is efficient in such cases.

Argyrol is considered the best local application for the gonococcus infection, acute and chronic, by Kevin,² after an experience with 2500 cases in the Jefferson College Dispensary. This opinion has been expressed by a score of conservative urologists and ophthalmologists.

Infection of the renal pelvis by the gonococcus was recognized by Gross³ as the cause of turbidity of the urine which had lasted since an attack of gonorrhœa one year earlier. By means of a ureteral catheter 10 c.c. of a silver nitrate solution, 1:1000, was injected into the infected kidney pelvis every four days. After ten such injections the urine became permanently clear.

Sterile yeast is recommended as a valuable remedy for the treatment of gonorrhœa and leucorrhœa in women by Papesaul.⁴ One quarter of an ordinary cake is swallowed three times daily. Abraham⁵ uses yeast locally also in treating gonorrhœa in women, retaining the yeast in the vagina by a tampon. He asserts that the living yeast cells destroy gonococci.

¹ Boston Medical and Surgical Journal, April 16, 1903.

² New York Medical Record, June 14, 1903.

³ New York Medical Journal, September, 13, 1902.

⁴ Wiener klin. Wochenschrift, June 25, 1903.

⁵ Monatsschrift f. Geburtsh. u. Gynäkol., 1902, Band xvi.

The antagonism of yeast, taken internally, to ordinary pus infections is fairly well demonstrated by its use against furunculosis and acne.

Tubercle Bacillus. The patient suffering from genito-urinary tuberculosis frequently fails to completely evacuate the bladder. Bryson¹ finds that the residual urine, drawn by catheter, frequently contains numbers of the bacilli, while that spontaneously voided does not. He, therefore, advises the examination of this residuum in cases of suspected urinary tuberculosis.

Bovée² discusses the complete extirpation of the diseased kidney and ureter—nephro-ureterectomy—and adds a personal case. Of the seventeen cases in which this operation has been performed fourteen were tuberculous and fifteen recovered from the operation (only two instances have been recorded outside of the United States). Bovée advises that the operation be entirely extraperitoneal, since most of the cases requiring it are tuberculous and the danger of peritoneal infection is great. He removed the lower end of the ureter through the vagina as the first step of the operation, which was completed through an oblique lumbar incision.

Reynolds³ reports seven cases of complete nephro-ureterectomy (in addition to Bovée's), with recovery in all.

Grohe⁴ reports fifteen nephrectomies for tuberculosis of the kidney, with eight deaths from extension of the tuberculous infection. Five were apparently well from two to twelve years after operation—33 per cent. of apparent cures.

Kelly⁵ considers that strictures of the ureter are most frequently due to tuberculosis of that canal, and that in this case extirpation of the kidney and ureter is the only reliable method of procedure.

Metz⁶ reports four cases of vesical tuberculosis cured without local treatment by the removal of a tuberculous kidney, thereby, as he thinks, removing the source of fresh infections. He emphasizes the opinion that severe bladder tuberculosis does not contraindicate the removal of the tuberculous kidney in the same subject. Metz mentions further interesting experiences with vesical tuberculosis. In one case three hundred hypodermic injections were made, each containing one-tenth centigramme of sodium cacodylate; a cure followed. In another case Guyon made instillations of mercury bichloride solutions and gave creosote internally. The vesical tuberculosis increased. The

¹ Journal of Cutaneous and Genito-urinary Diseases, 1902, p. 391.

² Washington Medical Annals, May, 1903.

³ Bulletin of Free Hospital for Women, June, 1903.

⁴ Archiv f. klin. Chirurgie, Band lxvi. p. 178.

⁵ Journal of the American Medical Association, vol. xxxix. p. 363.

⁶ Annales des mal. des org. gén.-urin., 1903, No. 14.

patient, a physician, refused operation and resorted to morphine for relief from the vesical distress. A complete cure gradually followed.

Another patient, a girl aged fifteen years, recovered under vesical instillations of creosote in oil (10 per cent.).

These cures, under widely varying or no treatment at all, illustrate the fact that vesical tuberculosis is frequently cured "spontaneously," which, of course, means by some influences not identified in the cases in question. The recognition of this spontaneous cure in many cases has led surgeons to adopt an intelligent conservatism toward urinary and vesical tuberculosis, and to believe that many of the successes ascribed to surgery have been due rather in large measure to the spontaneous and unidentified element.

Halle and Motz,¹ after an extensive and critical review of this subject, advise conservatism in the surgical treatment of genito-urinary tuberculosis, first, because the tuberculous foci are usually numerous and scattered, and, second, because spontaneous cures are frequent. I have preached and practised this doctrine for many years past.

Büngner² reports twenty-one cases of tuberculosis of the male genital tract treated by his operation of "high castration"—*i. e.*, avulsion of the infected vas deferens high above the external inguinal ring. He asserts that four-fifths of the entire vas deferens has been removed by this method. When avulsion fails to remove the entire diseased portion he injects into the remaining vas deferens an emulsion of iodoform in glycerin, and he asserts that in the cadaver this injected fluid reaches even the seminal vesicles.

Eight of the first eleven cases were cured by high castration, and have remained well for periods more than five years; two required the iodoform emulsion treatment after castration, and one died of miliary tuberculosis. All of the last ten cases were cured by the operation.

Büngner, therefore, claims 87 per cent. of recoveries by means of his high castration, while Bruns reported 46 per cent. cured by unilateral, 56 per cent. by bilateral castration of 111 cases observed for three to thirty-four years after operation.

Simon reports 66 per cent. of cures and Kocher 26 per cent. by castration.

Flick and Walsh³ found tubercle bacilli in the urine of forty-four out of sixty patients afflicted with tuberculosis of various organs, many of whom did not have tuberculosis of the kidney, as indicated by the symptoms.

¹ *Annales des mal. des org. gén.-urin.*, 1903, Nos. 7 and 8.

² *Beiträge zur klin. Chirurgie*, Band xxxv. Heft 1.

³ *Transactions of Pathological Society of Philadelphia*, vol. vi. p. 149.

Pus Infections. In 500 necropsies Green and Brooks¹ found disease of the bladder in 107 subjects; of these, sixty-four were instances of acute dilatation and four of rupture. The most frequent causes of bladder disease are lesions of the central nervous system and prostatic hypertrophy, both of which favor pus infection of the bladder.

Wildholz² describes a case of pneumaturia in a man aged fifty-two years. At the end of each urination a large amount of gas escaped from the meatus, with noise. The urine was cloudy and free from sugar; it contained a pure culture of *bacillus lactis aërogenes*; this organism produces an odorless gas, free from ammonia, in albuminous urine. Injected into the bladder of animals it produces pneumaturia only when albuminuria is induced (by subcutaneous injections of aloin) or glycosuria (by injections of phloridzin). The vesical infection is arrested by the ingestion of urotropin.

Forcast³ reports a lengthy series of experiments to determine the antagonism between *bacillus coli* and the urea-decomposing bacteria. He concludes: 1. That there is no antagonism between *bacillus coli* and the staphylococci. 2. That there is antagonism between *bacillus coli* and the streptococci, in favor of the former. 3. That there is such antagonism between the colon bacillus and *proteus vulgaris* of Hauser, in favor of the latter.

Albarran and Cottet⁴ report a study of the anaërobic bacteria concerned in infections of the urinary tract. They conclude that gangrene and sloughing of these tissues is chiefly caused by anaërobes.

Barth⁵ reports a case of cystitis following the gripe, due to *bacillus pyocyaneus* in pure culture. Urotropin and vesical irrigations cured the cystitis without banishing the bacilli, which, however, were apparently deprived of virulence by this treatment.

Bliss⁶ found among 311 cases of *typhoid fever* thirteen of bladder infection (cystitis) and eighteen of urinary infection (bacilluria), the earliest infection appearing on the twelfth and the latest on the forty-third day of the disease. Urotropin in large doses, fifteen to twenty grains every four hours, continued for days after the disappearance of the bacilli, was uniformly successful in banishing the infection.

Grohe⁷ reports three cases of unilateral *multiple renal abscess*. That the disease was unilateral was shown by the autopsy in one case and by the permanent cure of the other two cases. The pus infection was apparently hæmatogenous in all.

¹ Med. News, June 20, 1903.

² Korrespbl. f. schneizer Aerzte, 1903, No. 21.

³ Centralblatt f. Krankh. d. Harn. u. Sex. Org., July, 1903.

⁴ Presse médicale, 1903, p. 85.

⁵ Presse médicale, 1903, No. 43.

⁶ Edinburgh Medical Journal, October, 1902.

⁷ Archiv f. klin. Chirurgie, vol. lxvi. p. 178.

Edebohl¹ has substituted decapsulation of the kidney² for nephrotomy and drainage for the relief of pus infections of the renal pelvis, with more or less success. In several cases fixation of a movable kidney was combined with decapsulation. As the former measure alone has often relieved pyelitis, the amount of credit that should be ascribed to the decapsulation may well be debated. However, in one case of acute pyelitis and Bright's disease nephrotomy had produced only transient improvement; then decapsulation was followed by pronounced improvement, which existed at the time of the report, six months after operation.

Hahn³ directs attention to the influence of *uterine myomata* in inducing vesical irritation and cystitis. These effects are due not merely to pressure, but also to nervous influence. Bladder irritation may direct attention to myomata and constitute an indication for operative treatment of the latter.

TREATMENT. The discovery of the antecedent morbid lesion which so depresses the vitality of the tissues as to permit infection by pus bacteria remains the first item of treatment of these infections. Thus the treatment of cystitis begins with a search for tight stricture, enlarged prostate, stone, tumor, or other lesion; that of pyelitis with examination for obstructions in the lower urinary channel, dislocation of the kidney, renal calculus, etc. The next step in treatment is naturally the removal of this antecedent lesion when possible. Disease of the spinal cord, such as tabes, is apt to be overlooked as the possible cause of cystitis.

The direct treatment of the pus infection—cystitis—is usually futile until this preliminary search for a cause is successfully made. Urotropin internally, silver nitrate solutions locally, will arrest most pus infections, but will not, of course, prevent a fresh infection when the remedies are discontinued if the underlying cause be not removed.

Grünfeld⁴ had a patient who took urotropin for three years—seven to thirty grains per day—without harm.

Vindevogel⁵ affirms that after the ingestion of urotropin the blood contains urotropin, while the urine, especially after remaining in the bladder for hours, contains both urotropin and formaldehyde. The decomposition is effected by the acid medium. Yet it is the universal clinical observation that urotropin is especially effective in arresting pus infection with ammoniacal urine, as in cases of prostatic hypertrophy.

Smith⁶ states that the formaldehyde present in the urine after the

¹ British Medical Journal, November 8, 1902.

² See PROGRESSIVE MEDICINE, June, 1903.

³ Münchener med. Wochenschrift, 1902, No. 40.

⁴ Aertzliche Central. Zeitung, 1902, No. 40.

⁵ Annales des mal. des org. gén.-urin., 1902, p. 748.

⁶ Practitioner, February, 1903.

ingestion of urotropin reduces the copper salt in Fehling's test and interferes with the detection of small amounts of albumin by heat and acetic acid.

Hutchinson¹ tried the effect of many agents, including benzoic and boric acids, upon the acidity of the urine. He found that the acid sodium phosphate was practically the only agent that can be relied upon to increase this acidity. He administers two drachms of this salt dissolved in a pint of water, to be drank in small quantities at intervals during the day. Six times this quantity may be ingested without harm. He thinks the acid phosphate materially aids urotropin in sterilizing the urinary tract.

THE KIDNEY AND URETER.

Movable Kidney.² Persistent hemorrhage from a movable kidney is reported by Cabot.³ The bleeding ceased when the patient was kept in bed with the hips elevated, but began again when the upright posture was assumed. A series of trials brought uniform repetition of this result. Incision revealed the kidney freely movable in its fatty capsule, but otherwise normal. The fibrous capsule was split lengthwise and the cut edges stitched to the transversalis fascia. Permanent arrest of hemorrhage was secured by the operation.

Manton⁴ considers movable kidney the most frequent cause of *chronic appendicitis*, and states that of seventy-three women who had right movable kidney forty-eight showed symptoms of appendicitis.

The conservative treatment of movable kidney, advocated especially by Israel, is supported by McWilliams.⁵ For mechanical support he joins in the recommendation of the straight front corset, two sizes smaller than usual; it is applied before the patient rises in the morning, the kidney being replaced in its normal position by elevation of the woman's hips. The corset is hooked from below upward.

It is important to remember that the support of a movable kidney is obtained by pressure not above the level of the iliac crests, but upon the quadrangular space whose angles are the umbilicus, the two anterior spines, and the symphysis pubis.

Subparietal Injuries of the Kidney. Watson⁶ presents an elaborate discussion of injuries of the kidneys without laceration of the abdominal wall, based upon six personal cases and 660 reports gathered from cur-

¹ British Medical Journal, May 30, 1903.

² See PROGRESSIVE MEDICINE, June, 1903.

³ Boston Medical and Surgical Journal, vol. cxlvi. p. 243.

⁴ American Gynecology, 1903, No. 1.

⁵ Medical News, vol. lxxxi. p. 625.

⁶ Boston Medical and Surgical Journal, July 9 and 16, 1903.

rent literature. In many cases injury to the kidney was complicated by injury to other abdominal organs. In 486 uncomplicated cases there was observed a tumor in the loin, caused usually by retroperitoneal hemorrhage, hydronephrosis, or perinephric abscess. In 80 per cent. of the cases hæmaturia occurred, lasting eight days on the average. In 11 cases the renal rupture is said to have been caused by muscular contraction; in 20 by blows upon the abdomen, sometimes slight.

Of the 486 uncomplicated cases, 112 terminated fatally, 25 from hemorrhage, 25 from suppuration, 10 from anuria, and 9 from peritonitis.

The treatment must be determined by the indications. The only immediate serious feature is hemorrhage. This must be arrested, by a laparotomy if need be. When there are no symptoms of severe hemorrhage symptomatic treatment is best, subsequent developments being treated as they may arise.

Surgical Treatment of Bright's Disease. Edebohls¹ continues to be the most prominent advocate of this measure—decapsulation of one or both kidneys at one sitting. He reports 51 cases operated and only 2 rejected; in 47 cases both kidneys were decapsulated on the same occasion; 7 patients died within seventeen days; 7 more after an average interval of twenty months; 2 are unimproved; 22 are much improved, two to fifteen months after operation; 9 are cured, twenty-one months to ten years after decapsulation, averaging four years of health. A considerable percentage of the improved and cured cases were in a virtually hopeless condition before operation. A noticeable feature of the operated cases is the prompt increase in the urea excretion, which occurs in a few days sometimes, or in a few weeks; casts may persist for months, and albuminuria for some time longer. Decapsulation does not impair the function of the kidney; the only danger is the anæsthetic.

A woman, aged sixty-eight years, suffering from hemorrhagic nephritis, was submitted to double decapsulation. The hemorrhage ceased immediately, casts and albumin disappeared in fourteen days, and convalescence was complete in three weeks; then pneumonia supervened, terminating fatally a week later. Gross and microscopic examination proved the kidneys to be practically normal. Two cases of acute pyelonephritis were much improved by the same operation. One case of intermittent hydronephrosis, one of hydronephrosis, and one of cystic degeneration—all three subjects of chronic Bright's disease—were much improved by decapsulation, with fixation of the movable kidneys.

¹ New York Medical Record, March 28, 1903.

In the discussion¹ of this subject at the New Orleans meeting of the American Medical Association, Ferguson mentioned several cases of chronic nephritis symptomatically cured by decapsulation, some of which were reported before Edebohls' first article on the subject was published. Gibbons reported several, and Winslow one case of symptomatic cure of chronic nephritis by decapsulation.

Stricker remarked that no cures have yet followed decapsulation in cases where the fundus oculi was much diseased prior to operation; that the excretion of urea, not the loss of albumin, is the real test of the renal condition.

Horwitz² reports four cases of chronic nephritis with pain and hemorrhages operated on through a suspicion of renal calculus. In three nephrotomy was performed; in the fourth the capsule was split. All were symptomatically cured of the nephritis.

Edebohls³ reported to the American Gynecological Society a case of puerperal eclampsia in which the convulsions continued without abatement after delivery. Three days after the uterus was emptied double decapsulation was made, whereupon the convulsions promptly ceased and recovery followed.

Schmitt⁴ asserts that at the time of the publication of his article no cure of chronic Bright's disease by surgical intervention had been recorded; that nephrotomy, decapsulation, or even renal puncture may alleviate the pain and hemorrhage of chronic nephritis and re-establish the urinary secretion in anuria from acute infectious diseases; but that the chronic destruction of renal tissue continues.

Porter⁵ thinks that chronic nephritis is benefited by medical more than by surgical treatment; that the relief of dyspnoea and dropsy, the decreased loss of albumin, are brought about more effectually and safely without surgical intervention.

It has been assumed that among the factors resulting from renal decapsulation that tend to improve the condition of the kidney is the formation of anastomoses between the vessels of the renal substance and those of the surrounding tissues. To determine this matter Johnson⁶ performed decapsulation upon fifteen dogs, killing and examining the animals at various periods after the operation. In no instance could he discover any considerable anastomosis between renal and perirenal vessels. The kidney was surrounded by scar tissue.

¹ American Medicine, May 16, 1903.

² Journal of Cutaneous and Genito-urinary Diseases, 1902, p. 385.

³ American Medicine, May 23, 1903.

⁴ New York Medical Record, September 13, 1902.

⁵ Transactions of Lehigh Valley Medical Association, 1902.

⁶ Annals of Surgery, April, 1903.

This observation is directly opposed to that of Edebohls,¹ who had the opportunity to examine a kidney which he had decapsulated four months earlier. He found greatly enlarged vessels entering the kidney from the fatty capsule.

Blake² reports 5 cases of renal decapsulation for chronic nephritis; 2 were symptomatically cured, 2 died, and 1 was not improved.

Caille³ had a case of severe and intractable chronic nephritis in a child aged five years. Double decapsulation was made by Edebohls, with marked improvement in general condition, weight, and urinary features.

Israel and Pousson ascribe the benefit of the operation to relief of tension. The latter considers it of value in chronic nephritis with hæmaturia or nephralgia, and in acute or subacute infections.

Harrison punctures or divides the capsule for suppression of urine from scarlatinal nephritis, and for circulatory disturbances of the kidneys.

It seems to the writer that the exact status of this measure, the benefit to be expected from surgical intervention for the relief of chronic nephritis, is not yet finally determined, and Edebohls frankly expresses the same opinion. Two important facts must be kept in mind: first, that chronic nephritis is not a disease, an entity, but rather an anatomical condition (or several conditions) resulting from various causes, most of which have yet to be discovered, but all of which are doubtless to be found in toxic blood ingredients. Since the composition of the blood is not discoverably changed by renal decapsulation, it would seem improbable that a cure could be effected by any operation on the kidney, since the persistence of the toxic element in the blood must persistently continue the damage to the renal substance, even though large anastomoses be the result of the operative interference.

In those cases, on the other hand, in which, as in scarlatinal nephritis, we have reason to assume that the toxic element in the blood is a transient ingredient, removed by natural causes in a few days or weeks, and that the so-called chronic nephritis subsequent thereto represents not a persisting chronic toxic action, but the unrepaired damage of an acute, transient intoxication; in such cases it would seem possible that the relief of tension and improved circulation brought about by decapsulation might well constitute the beneficent factor necessary for repair of the damage inflicted months or years before.

The second item of moment is that the anatomical lesion, chronic nephritis, need not be and often is not a universally diffuse process

¹ American Medicine, May 30, 1903.

² Boston Medical and Surgical Journal, August 13, 1903.

³ Archives of Pediatrics, October, 1902.

involving both kidneys. Indeed, it is established beyond dispute that these anatomical changes may be limited to a portion only of one kidney, the remainder of this organ and all of its fellow presenting no morbid features discoverable by the microscope. Such local lesion might well be benefited by the operation under discussion.

The time-honored experience that "essential renal hæmaturia," so-called, is often permanently cured by simple nephrotomy or even splitting of the fibrous capsule of the kidney, and the later knowledge that such hæmaturia is frequently the result of chronic nephritis,¹ together constitute an *a priori* argument in favor of the belief that further experience will identify a certain group of cases now comprised in the general class loosely termed chronic nephritis that will be greatly benefited or even permanently cured by decapsulation, nephrotomy, or splitting of the renal capsule, and that these operations will accomplish results that medicine has not yet been able to furnish.

It is possible that the cases of chronic nephritis amenable to surgical treatment will ultimately comprise only those in which the renal circulation is impaired by mechanical causes, such as dislocation and mobility of the kidney, and that the sole important benefit of surgical intervention will be found to consist in fixation of the displaced organ and relief of intracapsular tension, whether the latter be accomplished by splitting the capsule, nephrotomy, or decapsulation being of minor importance.

Surgical Treatment of Anuria. The relief of anuria due to renal calculi by nephrotomy, first demonstrated by Lucas, has been so often and so successfully repeated that this operation is now the standard remedy for calculous anuria. Mendoza² relates a case in which anuria due to calculi, of twelve days' duration, was promptly ended by nephrotomy, with subsequent recovery. Bevan³ has performed the operation with successful result under nitrous oxide anæsthesia, thus eliminating the peril—especially great in this condition—of ether or chloroform. He advises early operation, on or before the third day.

Anuria from the toxic agents of acute infections and pregnancy has not yet been brought completely within the surgeon's domain, hence the case elaborately reported by Whitacre⁴ is of value. In this instance the anuria was incidental to abortion. It persisted for eight days in spite of medication by saline diuretics, digitalis, intravenous salt injections, etc. Then the decapsulation of one kidney (which was found to be large and purple in color) was followed by the excretion of twenty-

¹ See PROGRESSIVE MEDICINE, 1899, vol. iv. p. 118.

² Annales des mal. des org. gén.-urin, 1903, p. 673.

³ American Medicine, May 16, 1903.

⁴ Journal of the American Medical Association, May 23, 1903.

one ounces of urine in the first twenty-four hours, rapid increase of the quantity on the following days, and ultimate recovery ensued.

Cimino¹ relates a novel experience with calculous anuria. He introduced a ureter catheter into the left ureter up to the stone, and allowed it to remain in this position. In eighteen hours three ounces of urine were passed, and sixteen ounces in the next eight hours. The catheter was then withdrawn. The following night the calculus was passed spontaneously, the urinary secretion became profuse, and recovery ensued. His explanation is that the ureter was so dilated by the catheter as to permit the leakage of urine past the stone, thus relieving the back pressure on the kidney. Such treatment must, of course, in any given case be tentative, and if unsuccessful should soon give way to nephrotomy or splitting of the capsule.

Apolant² observed anuria for eight days in an elderly patient supposedly due to impaction of a calculus in one ureter and reflex spasm of the other. On the eighth day Nitze passed a catheter into the ureter supposed to be merely contracted. Ten quarts of urine were voided in the first twenty-four hours.

Pitts³ reports a case of anuria due to pressure on the kidneys and their vessels by an ovarian tumor to which pregnancy had been added. The removal of the tumor by ovariectomy was followed by restoration of the renal function.

Morphine in Uræmia. The treatment of uræmic convulsions by morphine is discussed by Hare,⁴ who secured the opinions of Tyson, Ewart, Billings, White, Musser, and Anders as to the value and safety of this measure. The consensus of opinion is that the hypodermic injection of one-eighth to one-quarter grain of morphine is valuable in the convulsions originating in acute nephritis, whether from pregnancy or other cause, but that it is less helpful and even dangerous in cases of chronic nephritis.

Carter and Edgeworth⁵ describe a case of interstitial nephritis in which uræmic attacks were repeatedly and promptly relieved by subcutaneous injections of morphine, one-quarter grain.

Solitary Kidney. Winter⁶ found post-mortem that a kidney he had removed was the only one possessed by the patient. He found in the literature seven cases of nephrectomy of a solitary kidney, all naturally fatal, and four cases of nephrotomy for suppurative lesions, all of which recovered. In these days of cystoscopes, ureter catheters, and methylene-blue tests such cases should become very rare.

¹ Policlinics, April 22, 1903.

² Deutsche med. Wochenschrift, 1903, No. 29.

³ Lancet, January 31, 1903.

⁴ Therapeutic Gazette, January, 1903.

⁵ British Medico-Chirurgical Journal, September, 1902.

⁶ Archiv f. klin. Chirurgie, Band Lxix., Heft. 3.

The absence of œdema after several days of complete anuria is an interesting phenomenon fully explained by a series of experiments on animals by Meltzer and Salant.¹ They find that the removal of both kidneys from an animal increases the absorption of water from the tissues and the peritoneum. The explanation evidently is that the increase in molecular (osmotic) pressure in the blood, due to retention of solids that should have been excreted, causes absorption of water from without the vessels. Fluids injected into the peritoneal cavity of nephrectomized animals is promptly absorbed into the blood current. Such absorption continues about twenty-four hours after nephrectomy.

Cryoscopy. The determination of the molecular concentration of the blood and urine by ascertaining the freezing point of each—cryoscopy—has been zealously studied during the past year. The results, while somewhat diverse in details, seem unanimously to support the contention of Koranyi, that a serious impairment of the renal excretion results in a depression of the freezing point of the blood below the temperature at which the blood of subjects possessing healthy kidneys freezes, and this freezing point of normal blood is almost uniformly found to be 0.56° C. below that of distilled water. Hence the persistent depression of the freezing point of the blood below 0.56° C., even to 0.58° C. or 0.60° C., is considered positive proof of deficient renal excretion, resulting in an abnormal concentration of the solid constituents of the blood.

This decreased excretion by the kidneys and retention of solids in the blood naturally results in the production of urine which contains less than the normal proportion of solids, and therefore freezes at a temperature higher than the freezing point of normal urine, which latter is found to be 0.9° C. (or thereabouts) below that of distilled water. In many cases of chronic kidney disease the freezing point of the urine is found to be habitually only 0.5° C. or even 0.2° C. below that of pure water.

Hence in pronounced impairment of renal excretion—that is, in many forms of kidney disease—we expect to find the freezing temperature of the blood lowered, that of the urine raised from the temperatures determined beyond doubt to be those of the two fluids as obtained from healthy subjects.

Some of the results actually obtained and published during the past year follow.

Rumpel² reports the observations made on 300 cases in Kümmell's clinic as follows :

¹ Journal of Medical Research, February, 1903.

² Münchener med. Wochenschrift, 1903, Nos. 1, 2, and 3.

The freezing point of the blood was found to be, in 125 normal subjects, 0.56° C. below that of water (which is 0° by the centigrade scale). In 77 cases of bilateral kidney disease (of many kinds) the freezing temperature of the blood was distinctly depressed—from 0.58° C. to 0.81° C. The blood showing the last-mentioned and lowest figure observed was furnished by a case of severe *uræmia* in a subject of chronic prostatic disease. In all these cases the freezing point of the urine was higher than normal—*i. e.*, from 0.8° C. to 0.2° C. instead of 0.9° C.

In 83 cases of unilateral kidney disease, on the other hand, the blood concentration and freezing point were normal, evidently because the undiseased renal tissue was performing the entire excretion necessary to health.

Rumpel, therefore, concludes not only that a depressed freezing point of the blood shows bilateral kidney disease, but also that a normal blood freezing temperature proves that renal disease, if present, is not bilateral. These conclusions are not, however, justified, as will be presently seen. They should read that a normal blood freezing point proves complete renal excretion, a depressed freezing point imperfect kidney excretion, and as a portion of one kidney, especially if this be hypertrophied as a consequence of disease of its fellow, may suffice to perform the entire work of the kidneys, it may happen that the freezing point of the blood remains normal even after both kidneys are diseased.

This assumption, *a priori* plausible, is virtually demonstrated by the important observation of Stockmann.¹ The case was apparently one of disease of the right kidney. The freezing point of the blood was found to be normal, and exploration of the right kidney was decided upon. Before the operation was undertaken, however, the patient died. The necropsy revealed a greatly hypertrophied and extensively tuberculous left kidney, but no trace of either kidney or ureter on the right side. The undiseased portion of the hypertrophied solitary kidney had apparently excreted the solids of the blood sufficiently to prevent their accumulation in the blood and consequent depression of the freezing point of this fluid.

In order to prevent mistaken and disastrous deductions of this sort, most surgeons employ the ureteral catheter and observe the quantitative and qualitative features of the urine from each kidney separately. Thus Rumpel² was enabled to show in eighty-three cases whose blood freezing point was normal that unilateral kidney disease existed, and that the freezing point of the urine from the diseased kidney showed diminished concentration. The integrity of one kidney may be further

¹ Monatshefte f. Urologie, Band vii., No. 10.

² Loc. cit.

shown by the prompt excretion by it of methylene blue (injected subcutaneously) and of sugar caused by injection of phloridzin.¹ Casper has for years practised this combination of cryoscopy with the ureter catheter and phloridzin injections. In a recent publication² he mentions eighty-eight cases in which the diseased kidney has been correctly identified by these measures, with evident advantage in determining the safety of proposed operative measures. In several of these cases the symptoms indicated disease of the opposite (sound) kidney. In no case did death result from unsuspected disease of the opposite kidney.

Israel, a consistent foe to the ureter catheter, stated that he had operated upon eighty kidney cases with five deaths, none of which was due to a mistaken diagnosis, yet in none had he used the ureter catheter or other measures advocated by Casper. The latter replied that as he had no access to the eighty cases mentioned by Israel, he would critically examine the diagnostic methods used by the latter in the cases recorded in his book published in 1901. Casper then dissected these cases, pointing out four fatal mistakes of Israel in removing a kidney whose fellow was already functionally insufficient through advanced disease—mistakes avoidable through the use of the ureter catheter, cryoscopy, and the phloridzin test—while Casper has had seventy-two cases of kidney operation without a death.

Strauss³ states that after 150 careful observations on many patients he is unable to draw a sharp line of demarcation between the freezing point of urine from healthy and from diseased kidneys.

Grine,⁴ after a careful study of 400 examinations of pathological urines, concludes that cryoscopy of the urine is a valuable aid to older diagnostic measures, especially when the ureter catheter is employed, and the phloridzin and methylene-blue tests are made.

Tinker⁵ considers cryoscopy of the blood a valuable means for determining the sufficiency of the renal function.

Tuffier⁶ had a patient one of whose kidneys discharged all its secretion through a fistula, while the urine from the other kidney was voided through the natural channels. He found that the ratio of work performed by the respective kidneys remains uniform during the twenty-four hours. This observation gives a needed corroboration of the value of the cryoscopic, methylene blue, and phloridzin tests, for there has

¹ See *PROGRESSIVE MEDICINE*, 1901, vol. iv. p. 102.

² *Deutsche med. Wochenschrift*, 1903, No. 25.

³ *Zeitschrift f. klin. Med.*, Band xlvii., Heft 5 und 6.

⁴ *Philadelphia Medical Journal*, March 21, 1903.

⁵ *Johns Hopkins Hospital Bulletin*, June, 1903.

⁶ *Presse médicale*, 1903, No. 14.

always been apparent the possibility that the work of each kidney varied in quantity and quality from hour to hour.

It would seem demonstrated, therefore, that cryoscopy of the blood furnishes a reliable index to the functional integrity of the kidneys, and that cryoscopy of the blood, combined with the examination of the urines obtained from the respective kidneys by the ureter catheter—including the determination of the freezing point, the promptness of excretion of sugar and blue by the phloridzin and methylene-blue tests—furnishes exact information of the functional activity of the respective kidneys. Fortified by such researches, the surgeon may forecast the danger involved in operating a kidney with a precision hitherto unattainable.

On the other hand, the skill required to catheterize the ureter will long remain limited to comparatively few; hence the differentiation of the functional activity of the respective kidneys must, like other methods conferring diagnostic precision, be restricted to those whose special opportunities warrant the acquisition of such skill. Cryoscopy of the blood and collective urines is, however, simple and practicable.

DILUTION TEST. It has been further discovered that when affected by various diseases a kidney separates excess of water from the blood less rapidly than does the normal organ. This fact has been utilized as a diagnostic test in the following way: The patient is required to drink a large amount of water. By the ureter catheter the quantities excreted in a given period by the respective kidneys are collected and compared in a volume. A marked difference is said to indicate improvement of functional activity in the kidney furnishing the less amount of urine.

Illyes and Koresi¹ practised this method in ten cases of renal lesions of different kinds. They assert that not only is there perceptible a difference in the volume of urine excreted by the respective kidneys in cases of unilateral renal disease, but also that in cases of bilateral disease—*e. g.*, chronic nephritis—the total excretion of both kidneys is distinctly lower than that furnished by normal kidneys.

Roeder² also states that after the ingestion of large amounts of water or of liquid food the healthy kidney excretes water in such excess that the freezing point of the urine rises from -0.9° C. to -0.3° C. or even -0.1° C., while the diseased kidney does not.

For obvious reasons this test is less positive and reliable than the cryoscopy of the blood combined with the phloridzin and blue tests of the urine, and since the dilution test is virtually quite as difficult and

¹ Centralblatt f. Krankh. d. Harn. u. Sex. Org., 1903, p. 345.

² Berliner klin. Wochenschrift, 1903, No. 19.

circumstantial, it cannot demand the consideration and study accorded to the latter.

Renal and Ureteral Calculi. Leonard¹ considers the radiogram, skilfully executed, decisive as to the absence as well as the presence of stones in the kidney or ureter. In only three cases (of 206 examined) in which the radiogram failed to reveal a calculus was a stone subsequently passed, and in two of these three cases the calculus weighed less than a grain.

Kümmell and Rumpel² radiographed 18 cases of suspected renal calculus, with positive result; in 16 the radiogram was verified by operation, in 2 by autopsy. The composition of these calculi is stated as follows: uric acid, 1; cystin, 1; carbonates, 5; oxalates, 5; phosphates, 6. The weight of the lightest was only $1\frac{1}{2}$ grains.

Johnston³ discovered by the X-ray calculi in 26 of 126 subjects examined. One positive picture was discredited by operation, which failed to reveal the pictured stone; one negative picture was proven incorrect by the spontaneous passage of a small stone. The smallest stone pictured weighed one-half grain.

F. T. Brown and Bieshof reported cases in which calculi were found by operation, though the X-ray had failed to reveal them. Bryson and Chetwood mentioned similar cases. I have reported a case seemingly of severe bladder and prostate infection. The cystoscopic examination discovered pouting of the left ureteral orifice. The radiogram showed calculi in the lower end of the left ureter. Glycerin was administered internally for five days, when the sudden relief of severe symptoms led to a second cystoscopic inspection, which showed calculous débris in the bladder. This was removed, with cessation of all morbid symptoms.

Young⁴ reported four cases of calculi in the ureter. In two they were removed from the lower end of the ureter through an extraperitoneal iliac incision, and in one by means of the cystoscope. In the fourth case spontaneous expulsion followed the ingestion of water in large quantity.

Klemperer,⁵ after discussing the various methods of treatment of renal colic, relates that in sixteen out of nineteen cases treated in the following manner stones were passed by the natural channel within two to eleven days: (1) massage of the ureters; (2) vibration massage of the kidney region. This treatment is adapted only to uncomplicated and aseptic nephrolithiasis.

¹ Medical News, vol. lxxx. p. 305.

² Beiträge zur klin. Chirurgie, 1903, Heft 3.

³ Journal of Cutaneous and Genito-urinary Diseases, 1902, p. 280.

⁴ American Medicine, August 9, 1902.

⁵ Therapie der Gegenwart, December, 1902.

Intermittent Hydronephrosis. Bazy¹ reports two cases of this lesion successfully treated by ureteropyeloneostomy. In each case the obstruction consisted of a fold of the mucous lining of the ureter due to distortion of that tube by external adhesions. Induced by this experience, Bazy examined the ureters of fifty newborn infants, and found the same condition in various degrees in several of them. He reviews the entire subject of intermittent hydronephrosis, and among his conclusions is the important one that resection of the pelvis, now becoming popular, must not be accepted as a routine operation, since in such cases as the two he reports the operation must of necessity be inefficient.

Remote Dangers of Kidney Operations and Injuries. Langemak² performed nephrotomy on seventy-five rabbits, and examined the operated kidneys at various periods after recovery from the operation. Infarcts of large size, sometimes of such extent as to destroy the secreting structure of nearly the entire organ, were usually found. In thirteen of these kidneys calculi also were found. He concludes that nephrotomy is not free from remote dangers.

Saboleff³ observes that unilateral ligation of ureter, renal artery, or nephrectomy causes nephritis of the opposite kidney, first parenchymatous, and later interstitial. This is proven by the examination of the urine. Consecutive to this nephritis there often occurs cardiac hypertrophy.

Castaigne and Rothery⁴ assert that mobility, hydronephrosis, or injury of one kidney causes degeneration of its fellow. This same result follows ligation of one ureter in an animal. They infer that the damage to the second kidney is done by the renal cells of the first (injured) kidney, which are absorbed by leucocytes and thus carried to the second kidney, producing an injurious effect similar to that experimentally induced in animals by intravenous injection of an emulsion of kidney cells. They make the deduction that movable and hydro-nephrotic kidneys should be operated at an early period.

Partial Nephrectomy is discussed in a series of elaborate articles by Rouville and Soubeyran.⁵ The salient points of the discussion are that partial nephrectomy is contraindicated in diffuse disease of the entire kidney as is usual in nephritis, in malignant disease, and in cases of permanent occlusion of the affected side; that it is applicable to cases of calculous disease with abscess formation and in pyonephrosis. Serous and echinococcus cysts should be excised with the adherent kidney tissue.

Tumor of Ureter. Albarran⁶ refers to a case of hæmaturia that had persisted for two years in a woman then aged thirty-six years.

¹ Revue de chirurgie, 1903.

² Beiträge zur klin. Chirurgie, 1902, p. 104.

³ Centralblatt f. Krankh. d. Harn. u. Sex. Org., 1903, p. 351.

⁴ Presse médicale, 1902, p. 1258.

⁵ Archives provinciales, vol. xi.

⁶ Presse médicale, 1902, p. 716.

He detected a tumor in the orifice of the left ureter; incised the upper part of the opening (from the bladder), thereby exposing the tumor completely. It was removed and found to be an adenoma. This is said to be the fourth case on record.

Stricture of Ureter. Kelly¹ remarks that stricture of the ureter has received comparatively little attention, though much study has been given to conditions that are most commonly caused by it, such as hydronephrosis and pyonephrosis. He has seen only one stricture at the renal end and one in the abdominal portion of the ureter. In all other cases the strictural portion was that contained in the true pelvis. In women the pelvic portion of the ureter can be palpated through the vagina. When strictured or imbedded in inflammatory exudate the resultant hardness and thickness are tangible. The diagnosis of stricture is made by the ureteral sound.

Treatment depends in part upon the cause. In some strictures of inflammatory origin dilatation by flexible or metal sounds up to 4 mm. or 5 mm. in diameter is feasible; in others, especially the numerous cases of tuberculous infection of the ureter, cutting operations are essential. These may comprise complete division of the stricture; resection of the ureter, which is seldom practicable in the pelvic portion; amputation of the ureter and implantation into the bladder; extirpation of kidney and ureter, the best method in cases of tuberculosis. Before operation the upper urinary tract should be emptied of stagnant urine and pus and irrigated by an antiseptic solution.

Young² mentions a case of stricture of the ureter due to perivesicular inflammation, whereby the ureter was tightly bound to the upper end of the seminal vesicle. Dilation of the ureter, renal pelvis, and kidney followed, requiring nephro-ureterectomy.

Ureteral Fistulæ. Peelis³ gives an exhaustive discussion of the various operations for the relief of ureter fistulæ, which are usually produced by abdominal and pelvic operations. Of the five operations—uretero-ureteral anastomosis, ureterovesical anastomosis, ureterorectal or sigmoidal anastomosis, obliteration of the ureter by ligature, and nephrectomy—each has a certain field of usefulness, but the implantation of the cut end of the ureter is deemed the best when feasible. A danger common to all anastomoses is that of obliteration of the ureter.

Stoeckel⁴ favors the intraperitoneal method of ureteral implantation into the bladder, and believes that the uncovering of the ureter is not so perilous to its nutrition as is commonly supposed. In all of his

¹ *Journal of the American Medical Association*, vol. xxxix. p. 363.

² *Annals of Surgery*, 1903, p. 668.

³ *Monatsh. f. Geburtshilfe und Gynäk.*, Band xv., Heft 3.

⁴ *Archiv f. Gynäk.*, Band lxxvii., Heft 1.

cases the ureter was dissected out for two inches or more, and in one for over three inches without harm. Implantation of the ureter into the bowel is too dangerous, because of the frequency of ascending infection.

Doucetot¹ furnishes an elaborate historical and critical review of the various operations for anastomosing the urinary with the intestinal tract, with bibliography.

Bovée² collects 111 cases of ureterocystotomy, with 6 per cent. mortality. He considers peritoneal drainage essential. The chief danger is infection.

Noble said the difficulty of connecting ureter to bladder, due to the close adhesion of the peritoneum, was in one of his cases overcome by incising the peritoneum on either side of the ureter for two and one-half inches, thereby lengthening the ureter by an inch.

Polk said that implantation of the ureter into the bladder must lead to constriction, stenosis of the new orifice, and consequent damage to the ureter. Ureteral anastomosis should be performed when practicable.

Robinson³ describes the varieties of the renal pelvis found in various subjects.

Murphy⁴ advocates resection of the pelvis and, if need be, of the kidney for the cure of pyonephrosis to reduce mortality.

THE BLADDER.

Removal of Metallic Bodies from Bladder by a Magnet. Hofmeister⁵ describes the easy withdrawal of an iron pencil from the bladder of a man by the attraction of a magnet such as is used for the extraction of foreign bodies from the eye. The pencil was two and a half inches long, and one-fourth of an inch thick. A metal sound was made the core of a magnet by insertion into the coil. When this sound was introduced the pencil was at once attracted, its contact being indicated by a distinct impulse. The sound was gradually withdrawn, the bladder neck preventing the pencil from entering the urethra until it became axial with the sound. It adhered to the tip of the sound during its passage through the urethra.

An attempt to extract a hairpin from a woman's bladder by the same manœuvre failed, because the pin was fixed in the bladder wall.

¹ *Annales des mal. des org. gén.-urin.*, 1902, p. 758.

² American Gynecological Society, *American Medicine*, June 6, 1903.

³ *New York Medical Journal*, May 25, 1903.

⁴ *American Medicine*, June 20, 1903.

⁵ *Beiträge zur klin. Chirurgie*, Band xxxv. p. 830.

Kapsommer and Nossal¹ relate additional cases of calculous formation in the bladder around sutures which had been introduced during operations for hernia, and had probably been made to include the bladder. As the bladder is dislocated toward the inguinal ring in a large percentage—perhaps one-fourth—of the cases of hernia, care not to include it in the sutures is needful.

Stockmann² and Kreps³ describe cases of that rare condition which is termed leucoplakia of the bladder.

Fœtus Extracted from Bladder. Garsig⁴ reports a case of complete retention of urine in a woman, several months pregnant, who had been for several days the subject of chills, fever, and intense irritation of the bladder. Garsig detected some foreign body in the bladder, and extracted piecemeal through the urethra (having incised the meatus) a fœtus of about three months' gestation. Complete recovery of bladder functions ensued.

Double Bladder. Cathelin and Sempé⁵ discuss the development of double bladder, with a presentation of fifteen cases collected from the literature. They consider that the most plausible explanation of this anomaly is the presence of a double allantois.

Bilharzia Infection of the Bladder. Goebel⁶ discusses the treatment of bilharzia cystitis. The mild cases are ultimately cured by the administration of urotropin and the institution of a tonic regimen. Severe cases may require curettement of the bladder through a suprapubic incision. He has successfully operated upon seven cases in this way.

Ulcer of the Bladder. Armstrong⁷ presented to the American Surgical Association the reports of two cases of simple ulcer of the bladder. In one case necropsy eight months after the symptoms showed general miliary tuberculosis. In the second case, a boy aged twelve years, the ulcer was healed by intravesical injections of silver nitrate solutions.

Estes added a case whose symptoms led to a diagnosis of septic peritonitis, for which laparotomy was performed. A perforating ulcer of the bladder was found, and recovery ensued.

Rupture of the Bladder. Jones⁸ reports two cases of intraperitoneal rupture of the bladder and collects seven more, making—with Alexander's table of forty-five cases—a total of fifty-four cases treated by suturing. The mortality of the whole series is 48 per cent., but the

¹ Semaine médicale, 1903, No. 3.

² Centralblatt f. Krankh. d. Harn. u. Sex. Org., 1902, p. 621.

³ Ibid. p. 627.

⁴ Annales des mal. des org. gén.-urin., 1902, p. 908.

⁵ Ibid., 1903, p. 339.

⁶ Deutsche Zeitschrift f. klin. Chirurgie, Band lxvi., Heft 3 und 4.

⁷ American Medicine, May 23, 1903.

⁸ Annals of Surgery, vol. xxxvii. p. 215.

improvement in the surgical treatment is shown by the fact that the mortality of all cases reported prior to ten years ago was 63 per cent., but of those reported in the past ten years only 28 per cent. This improvement in results is in large measure due to improved technique. The chief factor in mortality is, of course, septic infection of the peritoneum. This often takes place at the time of the injury, but may be due to the introduction of a catheter, or to the air or fluid injected, as a diagnostic measure, through the catheter. These measures Jones condemns.

He advises that in every case of suspected bladder rupture the pre-vesical space should first be opened without injury to the peritoneum. If the rupture is found to involve the peritoneum this sac must be incised and the patient placed in the Trendelenburg position for further manipulation. In suturing the bladder the stitches should be introduced first at the upper end of the wound and left long, so that each may be used in drawing the bladder upward to facilitate the introduction of the next stitch. The wound should be drained with gauze.

The prominent symptoms in Jones' own cases were sudden, severe, and persistent pain in the lower part of the abdomen, constant desire to urinate, a preference for a partially erect rather than the recumbent position of the body.

Trabe¹ presents an elaborate discussion of vesical rupture based upon thirty-five cases collected from the literature, without noteworthy additions to previous knowledge.

Albarran² made a suprapubic cystotomy three times on the same patient—in 1893 (when the subject was fifty years old), in 1895, and in 1902. The first operation was for the removal of an epithelioma, which did not recur; the second for a papilloma (in a different part of the bladder), and the third for pedicled tumors. The subject is now free from vesical symptoms, and although the three incisions were made through the same place, his abdominal wall is whole and free from hernia.

Incontinence of Urine. Eekstein³ reports another cure of vesical incontinence in a woman, aged seventy-six years, by the injection of paraffin around the urethra.

Hock⁴ observed a woman, aged twenty years, who presented complete incontinence of urine after the removal of a large vesical calculus through the urethra. Three operations for the relief of the incontinence had been made in vain. Hock first performed Gersuny's torsion

¹ *Centralblatt f. Krankh. d. Harn. u. Sex. Org.*, March, 1903.

² *Annales des mal. des org. gén.-urin.*, 1903, No. 14.

³ *Berliner klin. Wochenschrift*, March 30, 1903.

⁴ *Prager med. Wochenschrift*, 1903, No. 6.

of the urethra, with but little benefit. He then injected six grammes of paraffin into the vicinity of the bladder-neck, with great improvement. Two subsequent injections were followed by practical cure of the incontinence, which had lasted eighteen months at the time of the report.

Jaboulay¹ observed a girl, aged eighteen years, who had suffered from vesical incontinence for many years, and for whom bromides, section of the meatus, and epidural injections had been employed without success. He conceived the idea of compressing the sacral and hypogastric plexuses by distending the perirectal tissues with air, and to this end he injected five ounces of air through the raphé between the sacrum and rectum. Emphysema followed as high up as the supra-clavicular spaces, and for several minutes there was alarming cardiac fluttering. The incontinence of urine was, however, immediately and permanently cured. He very wisely advises that air be not employed for future experiments, and says that he will use a saline solution instead.

Kapsamer² has treated twenty-five cases of incontinence of urine by epidural injections. In nine the cure had lasted for six months. He thinks the therapy is merely that of a shock to the spinal cord.

Bergonignan³ reports that painful reflex anuria in an ataxic woman was relieved by a single epidural injection of fifteen minims of a 2 per cent. cocaine solution, after which large quantities of urine were voided without pain. Six months later a return of the urinary disturbance was again successfully treated by a similar injection. He has used this method in several cases with success.

Cathelin⁴ states that he has cured 75 per cent. of cases of incontinence by epidural injections, and has had great success in the treatment of all kinds of neuropathies of the genito-urinary organs, including pollutions and impotence. The shock favorably affects the roots of nerves and centres in the cord. Strauss⁵ has had equally favorable results from this method.

Segregation of Urines from the Respective Kidneys. Although it is now generally admitted that the partition of the bladder into two lateral compartments, each comprising the orifice of a ureter, cannot be accepted as a substitute for the ureteral catheter in securing the urines from the respective kidneys, yet new instruments for such partitioning of the bladder for this purpose have been presented, and the older instruments have been recommended anew by their inventors. In

¹ *Revue mensuelle des maladies de l'enfance*, vol. xxi., No. 5.

² *Semaine médicale*, 1903, No. 27.

³ *Journal des praticiens*, 1902, No. 33.

⁴ *Revue de gynécologie*, vol. xii., No. 3.

⁵ *Berliner klin. Wochenschrift*, 1903, No. 33.

PROGRESSIVE MEDICINE, 1899, Vol. IV. p. 134, it was stated, in a criticism of the Neumann and Harris instruments, that the limitations theoretically evident have been demonstrated in practice. Two serious defects are obvious: Each of the catheters drains half the bladder as well as one kidney, and the flow from it must include any pus, blood, bacteria, etc., that may be furnished by the vesical lining, since the bladder mucous membrane is not abolished, but corrugated, when this viscus is empty. Again, the partition wall may well be defective through firmness of the trigonum, diverticula, enlargement of the prostate, etc., and the instrument affords no means for determining whether the partition is water-tight. These theoretical criticisms have already been realized in practice by different observers.

The use of these instruments is, moreover, painful in the extreme and not devoid of danger to the vesical lining. Their use is justified—as was stated in this review a year ago—only when ureteral catheterism is impracticable, and then only as a supplement to the cystoscope.

Cathelin¹ furnishes a very long and verbose article recommending his instrument for partitioning the bladder, and describing some changes from the original model.

Luis² describes some improvements in his instrument and recommends its use.

Hartmann³ related a case in which the Luis divider showed that the left kidney was diseased, though the symptoms indicated a lesion of the right kidney. Exploration confirmed the findings of the instrument.

Quénu related a similar experience with the Cathelin divider.

Bazy reported a case in which the Cathelin instrument furnished purulent urine from both sides, hence presumably from both kidneys. Exploration proved one kidney healthy, all the pus emanating from the other.

Cohn and Posner⁴ find that all the dividers yet constructed are absolutely unreliable.

Lichtenstern,⁵ as the result of independent experience, expresses the same opinion.

Rochet and Pellanda⁶ assert on the basis of experience that all instruments that seek to secure segregation of the urines by partitioning the bladder are essentially uncertain. They present a contrivance on a dif-

¹ *Annales des mal. des org. gén.-urin.*, 1902, No. 12.

² *Gazette hebdom.*, December 11, 1902.

³ *Soc. de chirurgie*, October 8, 1902. *Guyon's Annals*, 1902, p. 913.

⁴ *Berliner klin. Wochenschrift*, 1903, No. 16.

⁵ *Wiener med. Presse*, 1903, No. 13.

⁶ *Gazette hebdom.*, December 14, 1902.

ferent plan to the same end. In their instrument one ureteral orifice is closed by the pressure of a rubber bag, which is contained in the instrument, introduced into the bladder in a collapsed state, and then distended with air so as to (presumably) press upon and close one ureteral orifice. The urine from the opposite ureter is allowed to flow out through a tube. They assert that they have proven the accuracy of this instrument most satisfactorily.

The writer of this review had an instrument constructed on this same plan by a firm of Chicago instrument makers about sixteen years ago. The pressure of one ureter was attempted by distending the rubber bag not with air, but with quicksilver, which should certainly give sufficient pressure when the patient's body is turned toward the side whose ureter it is desired to close. This instrument was used enough to make its unreliability apparent to the inventor. It was, therefore, never recommended to the medical profession. It reposes on the shelf of oblivion, to which these later and more widely heralded instruments designed for the same purpose—from Neumann's to Rochet's—should be—and by most surgeons have been—consigned.

THE PROSTATE.

Calculi. Erdmann¹ removed fifty prostatic concretions by perineal incision, in a man aged twenty-three years.

Abscess. Blanquinque² reports twenty-six cases of prostatic abscess opened and healed by incision from the rectum, the anus being first dilated by a Sims speculum. In my opinion there can be no question that incision from the perineum is the proper route for evacuation of a prostatic abscess, for obvious reasons.

Cancer. Greene³ describes two cases of cancer of the prostate found in fifty-eight cases examined. He collects from the literature seventy-one autopsies of prostatic cancer; in 85 per cent. of these the nearest lymph glands—retroperitoneal and inguinal—were involved, and in 5 per cent. the axillary glands were cancerous. In one case the right lobe, removed by prostatectomy, was cancerous, while the left showed simple hypertrophy.

Oraison⁴ states that of 306 prostatic patients treated at the Necker Hospital during three years 28 were found to have cancer of the prostate; 16 out of 170 observed at another hospital were afflicted with cancer. Albarran and Holle found post-mortem 14 out of 100 enlarged prostates to be cancerous, in 10 of these a simple hypertrophy having

¹ Medical News, March 7, 1903.

² Presse médicale, 1902, No. 44.

³ American Medicine, May 30, 1903.

⁴ Annales des mal. des org. gén.-urin., 1903, p. 641.

been transformed into carcinoma. The total is, therefore, 58 cases of cancer out of 576 cases of prostatic enlargement, or 10 per cent.; and in my opinion this ratio of cancer is not at all above the general average.

Oraison reports on 23 cases of extirpation of the cancerous prostate by the perineal method, made more than four years earlier: 4 died of the operation; in 6 there was operative recovery, with subsequent history unknown; in 3 there was fatal recurrence in nine to fourteen months; and in 10 the cure has lasted over four years. When the cancer has passed beyond the prostate, abstention is the wiser plan.

I have been impressed with the frequent painlessness of prostatic cancer, having observed several cases in which no anodyne whatever was given nor required, even to the fatal termination. There can be no doubt that many cases of prostatic cancer are never differentiated from the more frequent senile hypertrophy; indeed, the latter is not infrequently the preliminary stage of cancer, as is shown by the cases occasionally observed—such as Greene's case above noted—in which the two morbid processes coexist for a time. In two recent cases of prostatectomy, made by different surgeons, the cancerous nature of the enlargement was unsuspected until the parts removed were examined.

In a recent personal case of painless prostatic cancer complete paraplegia developed within ten days. As no necropsy was allowed, the exact site of the metastases remains undemonstrated.

Hypertrophy. Another chapter has been written in the history of the zealous, though not always intelligent, modern surgery of the hypertrophic prostate. The first phase of its development was furnished by the present writer, and independently, though later, by McGill, in the eighties—the suprapubic removal of projecting prostatic adenomata. To this was added, by myself, a perineal urethrotomy, to facilitate the removal of these growths. In 1889 Dittel proposed, and a year later Kocher executed, the exposure of the rectal surface of the prostate through a transverse perineal incision, division of its capsule, and removal of its structure—perineal prostatectomy. In 1893 Ramm executed, and White independently proposed, castration as a means of inducing atrophy of the prostate; Harrison substituted vasectomy shortly thereafter. A few years later Freudenberg resurrected from its thirty years' interment the Bottini operation. Shortly thereafter Freyer extended the scope of the suprapubic operation by removing virtually the entire prostate; and finally, within the last three years, the perineal prostatectomy of Dittel and Kocher has been performed with manifold variations, more frequently and universally than all the other operations combined.

It is now the general conviction that the so-called sexual operations—castration and vasectomy—and the modified Bottini operation should

be abandoned, though individual instances of complete relief from the evils consequent upon prostatic hypertrophy must undoubtedly be credited to each. As I have through various channels, including PROGRESSIVE MEDICINE, for four years past, elaborated the reasons for opposing these operative measures, and as they are now but seldom practised, further consideration of them will be omitted from this review.

PROSTATECTOMY. The removal of a part or the virtual entirety of the prostate through an incision now occupies the entire field. The differences of opinion and of practice are concerned with (1) the avenue of approach, and (2) the method of removal of the prostatic tissue.

THE SUPRAPUBIC INCISION, as the sole and sufficient route to the prostate, is now advocated by but few, chief among whom is Freyer. This surgeon, whose previous extensive experience in operations for vesical calculus entitles him to respectful hearing, reports¹ thirty-one cases of extirpation of the entire hypertrophied prostate through a suprapubic cystotomy. The subjects ranged in age from fifty-eight to seventy-nine years; the prostatic tissue removed weighed from 1½ to 10¼ ounces in different cases. Four of the patients died; twenty-two recovered from the urinary troubles that had reconciled them to operation. The prostate is enucleated by Freyer without cutting more than the mucous membrane covering it; the suprapubic incision, with elevation of the prostate by a finger in the rectum, enables an operator with ordinary finger length to extirpate the gland down to its capsule.

That suprapubic cystotomy carries a special danger of septic infection of both the prevesical connective tissue and the raw surfaces from which the prostate has been enucleated cannot be gainsaid, and is illustrated in the high mortality percentage attendant upon an operator so experienced and skilful as Freyer.

THE VARIOUS PERINEAL INCISIONS have the advantage—especially desirable in these aged patients with infected bladders and kidneys and lowered tissue vitality—of perfect drainage; this fact explains the lower mortality attending perineal prostatectomy, as reported by operators of relatively small experience in vesical surgery, while those of greater experience report a mortality of less than 5 per cent. Thus Albarran² reports perineal prostatectomy on 42 subjects averaging sixty-three years of age, with 1 death; there were 35 complete cures, 2 distinct improvements, and 3 were not followed. Murphy³ operated on 34 cases, with 1 death; Young,⁴ 12 cases, without mortality;

¹ British Medical Journal, April 18, 1903.

² Annales des mal. des org. gén.-urin., December, 1902.

³ Chicago Medical Recorder, August, 1903.

⁴ American Medicine, 1903, p. 813.

Goodfellow,¹ 26 cases, with 1 death; MacGowan,² 28 cases, with 4 deaths.

THE DISADVANTAGES OF THE PERINEAL OPERATIONS are: (1) difficulty in reaching the prostate; (2) troublesome hemorrhage; (3) danger of wounding the rectum; (4) persistence of a perineal or urethrorectal fistula; (5) abolition of the sexual function; (6) permanent incontinence of urine; (7) failure to remove the obstacle to urination.

The difficulty in exposing and controlling the prostate for the necessary manipulations is, especially in obese subjects, a serious drawback to the operation, which has not been satisfactorily averted by the various intravesical retractors and different tenacula commonly used. Young³ figures an instrument of his own device, which he states has revolutionized the operation of perineal prostatectomy in his hands by giving him perfect control of the prostate. If that shall be the general experience the operation will be entitled to a claim of completeness which cannot otherwise, in my opinion, be conceded to it.

The hemorrhage, which is often most troublesome and sometimes even disquieting, is mostly due to injury of the urethral bulb by the incision, or to laceration of the prostatic plexus during the attempts to extract the prostatic tissue. As this plexus lies outside of the capsule, it should not be torn; but as the operator's work in evicting the prostate is done more or less obscurely, such laceration of the plexus does sometimes occur. The incision into the urethral bulb occurs when the skin incision is not wisely chosen—a matter to be presently discussed.

The danger of wounding the rectum, with a probability of causing a urethrorectal fistula, is imminent, because of the necessity for peeling the rectum away from the prostate in gaining access to the latter. This mishap has befallen so skilled an operator as Albarran.

The abolition of the sexual function, to which Murphy especially has directed attention, cannot result from the removal of the prostatic tissue, since the removal of the entire prostate in rats does not diminish their sexual power, though causing sterility (Walker⁴). The probable explanation is the damage to the perineal muscles concerned in erection of the penis, either directly by the knife or indirectly through the resulting cicatrix. Young⁵ states that in his twelve cases operated on with the aid of his new retractor there was no impairment of the sexual function produced by the operation; and this seems to be the usual experience.

Failure to remove the obstacle to urination was observed by Eastman,⁶ who made a complete perineal prostatectomy in a patient aged sixty-

¹ California Academy of Medicine, April 29, 1902.

² New York Medical Journal, June 27, 1903.

³ Johns Hopkins Hospital Bulletin, March, 1901.

⁴ Medical News, September 5, 1903.

⁵ Loc. cit.

⁶ Loc. cit.

nine years, without opening the urethra and without relieving the complete retention. Three weeks later he made a perineal urethrotomy, and found a rigid, contracted vesical orifice. This he divided with the galvanocautery, after which voluntary urination was restored.

The incision for exposing the prostate is variously made; the needlessly extensive curvilinear cut of Zuckerkandl and lozenge-shaped incision of Kocher have been, in this country at least, generally abandoned. It is to be remembered that the deep dissection must be made below the level of the urethral bulb—*i. e.*, within an inch or so of the anal margin. An incision beginning one and one-quarter inches in front of the anus in the median line, and extending obliquely to a point midway between the anus and the tuberosity of the ischium on either side, when carried deeply by blunt dissection, brings the operator to the posterior margin of the bulb; a clean, transverse cut through the deep fascia at this point opens the posterior perineal space and affords easy separation of the rectum from the membranous urethra and prostate. In obese patients the extension of the superficial incision forward for an inch along the raphé increases the operator's ability to gain lateral space through retractors.

The separation of the rectum should be done most carefully by blunt dissection; the membranous urethra is then divided on a grooved staff and the index finger inserted into the bladder, where it explores for calculi and determines the contour and extent of the prostatic deformities. The capsule is then divided and the prostatic masses enucleated when possible, otherwise removed by morcellement. It is neither necessary nor wise to insist on removing the entire suburethral prostate if enucleation be impossible; the restoration of a low-level channel through the prostate is the end sought.

Murphy¹ has in three cases removed the suburethral prostate *en masse*, with its mucous covering. He describes the technique as follows: Having pushed the rectum backward and divided the capsule of the prostate, the handle of the scalpel is used "to free the capsule from the prostate on both sides sufficiently to allow the insertion of the index finger, which liberates the capsule from the lateral lobes and posterior isthmus back to the bladder wall. A short, broad Sims speculum is then inserted and used to displace the rectum and capsule backward. One four-pronged cat's paw hook retractor is now put in each lateral lobe as far back toward the bladder as possible and used to draw down the prostate *en masse*. A long, curved scissors now divides transversely the posterior urethra anterior to the prostate. The division is then continued on each side through the lateral attachment of the anterior

¹ Chicago Medical Recorder, August, 1903, p. 158.

isthmus to the posterior boundary of the prostate. This boundary can be readily recognized, as the urethra is open. The prostate is now free from all its connections anteriorly and laterally, and is removed entire when the urethra posterior to it is divided transversely. The lateral edges of the posterior urethra are brought together to form a continuous canal," leaving space for a drain into the bladder. "The hemorrhage was so slight as to scarcely deserve the name. Every step of the operation was open to inspection, and the post-operative shock was *nil*. Convalescence in all three was rapid and gratifying."

If this technique shall secure equally good results wherever used it will constitute a distinct advance for perineal prostatectomy.

To summarize: Suprapubic prostatectomy is often inefficient in restoring the urinary channel and function; moreover, it does and must carry a serious intrinsic danger of septic infection. Perineal prostatectomy is likewise inefficient in many cases, in that a clean removal of prostatic tissue under visual control is impossible; and the surgeon who persists in working in the dark is apt to do serious harm, resulting in damage to the rectum, urinary fistulæ, and incontinence. I am still convinced that a combination of suprapubic and perineal incision affords the only complete and satisfactory command of the prostate in all cases; and the perineal drainage thus secured averts the one serious objection to the suprapubic incision—the danger of sepsis. The suprapubic access, moreover, removes the necessity for extensive incision and blind dissection in the perineum. It seems that with our present knowledge the best general plan is to begin with the small inverted V incision already described; if, on account of obesity of the patient, depth or fibroid consistence of the prostate, serious difficulty is experienced in the digital and visual control of the prostate, a suprapubic incision should be added, whereby these difficulties are minimized to a degree unattainable through the perineal route alone. Certainly our present experience does not warrant the belief that perineal prostatectomy—by any of the variations as yet practised—is adapted for the removal of all of the deformities and hypertrophies of this gland; possibly out of the zealous attention which it is now receiving throughout the surgical world there will be evolved an operation efficient in all cases. While the present popularity of perineal prostatectomy, with its flood of journal reports of brilliant successes, forcibly recalls the brief but exciting careers of the now virtually obsolete sexual and Bottini operation; yet we may confidently predict that perineal prostatectomy, unlike those irrational procedures, has come to stay; the points yet to be decided are the limitations and the detail of technique of this operation.

When shall we Operate? Since the chief element of danger to life from prostatectomy of any sort arises from the impairment of the kidney

tissue directly due to the prostatic obstruction, and from the waning vitality of age, it is obvious that operation at an early stage of the disease is advantageous. On the other hand, it is well known that serious impediment to the exit of urine from prostatic hypertrophy may exist for many years without perceptible disease of the kidney or impairment of the general vitality; hence the proposition made in certain quarters to operate on every case of prostatic hypertrophy as soon as recognized, irrespective of local and general condition, cannot be seriously entertained. A judicious recognition of the patient's welfare, as well as of the surgeon's operative zeal and pecuniary ambition, must be allowed. In this as elsewhere in surgery no infallible directions can be furnished for all cases; the experienced and honest operator will oftener avoid than advise operation in the cases of limited disease.

Prostatism without Prostatic Hypertrophy. The clinical symptoms induced by prostatic hypertrophy often exist in the absence of such hypertrophy. For these symptoms, including cystitis and complete retention of urine, may be caused by any one of three lesions: (1) pus infection of the prostate; (2) contracture of the bladder-neck; (3) hypertrophy (adenofibroma) of the prostate. Either of these may exist alone or in combination with the others.

1. Pus infection of the prostate, not rare in elderly men, produces an inflammatory enlargement (not a hypertrophy) of the prostate, just as pus infection of the skin follicles causes inflammatory enlargement of the skin (furuncle).

2. Contracture of the bladder-neck is a frequent condition which receives but little attention from recent writers on prostatectomy; it is absolutely independent of hypertrophy of the prostate, though productive of the same symptoms; it is a degeneration of the vesical orifice, which is quite independent of the prostate; as a result of this degeneration the vesical orifice is unable to dilate when the subject desires to urinate, and hence all the symptoms of real prostatic hypertrophy are produced, though the prostate be normal. This contracture of the bladder-neck is found in young men, in boys, even in women, showing that the prostate is not necessary either to this condition of the bladder-neck or to the symptoms clinically ascribed to prostatic enlargement.

These two conditions and the real hypertrophy may exist independently or in combination; and a careful discrimination between them is essential not only in prescribing treatment, but also in appraising the value of the results of operation. For example, there are many cases in which a man fifty to sixty years of age is troubled with the classical symptoms of prostatic hypertrophy; examination reveals pus infection of the prostate and inflammatory enlargement. By massage and silver nitrate injections this infection is eradicated, the inflammatory swelling

subsides, the patient is cured. Prostatectomy would score a brilliant success in such a case, though neither necessary nor justifiable; even castration used to cure them, though futile against real hypertrophy.

A critical examination of the remarkably good results of perineal prostatectomy—as of castration and the Bottini operation—shows that few operators recognize the distinction here discussed, but operate indiscriminately according to symptoms, not according to the requirements of the case. This must be remembered in estimating the value of perineal prostatectomy.

Prostatotomy by Galvanocautery. There will doubtless always be a field for an operation which attempts not the removal of the entire prostate, but the channelling of obstructing portions by the galvanocautery. That this operation—less severe and dangerous than any form of prostatectomy—is often efficient, is shown by the undoubted success sometimes blindly secured by the Bottini procedure. By incising the membranous urethra, and thus securing digital control of the cautery instrument, the surgeon can secure a definite result. This operation—first made by the present writer in 1885—has been practised by Chetwood,¹ who has devised a special cautery instrument for this purpose. He reports 45 cases of this operation, 33 of which were cured or materially improved, 5 somewhat improved, 3 not benefited (2 of these were tuberculous), 1 died of the operation and 3 of complications.

THE VESICLES.

Fuller² reports a series of twelve operations on the seminal vesicles—nine for *chronic vesiculitis* and three for the drainage of abscesses. The sexual power was recovered in five to six months after operation. There were no deaths, but in one case extensive perforation of the rectal flap occurred. Fuller exposes the vesicles by incision from the perineum; this affords complete access to the vesicles, but requires an extensive wound, with the chance of complications with the urethra and rectum, such as actually occurred in one of his cases. Drainage of vesicular and perivesicular suppuration is more simply made by incision from the rectum—the plan followed by the present writer and advised also by Keyes.

THE EXTERNAL GENITALS.

Treatment of Undescended Testicle.³ Mignon⁴ reports a new method for transplanting an undescended testicle into the scrotum,

¹ Medical News, August 8, 1903.

² Journal of the American Medical Association, May 4, 1903.

³ See PROGRESSIVE MEDICINE, June, 1903, p. 137.

⁴ Société de chirurgie, July 2, 1902.

namely, severing all vesicles and leaving the vas deferens intact. The basis for this is, he says, the fact that the vas possesses nearly or quite its normal length, while the vessels are too short, their brevity preventing the descent of the organ. In three cases in which he performed this operation neither subsequent retraction of the organ nor necrosis or atrophy thereof occurred.

Bazy mentioned a case operated on six years earlier, in which testis and virility are apparently perfect. The subject was but fourteen years old when operated on. Bazy advises that the testicle be transplanted before puberty.

Routier narrated a case in which the operation advocated by Mignon was followed by necrosis of the testicle two weeks later. Kirrison considers the spermatic artery essential to the integrity of the testis, and advised against the Mignon procedure.

Broca referred to 138 operations for hernia with undescended testicle, published three years earlier. At the end of a year the examination of 79 testicles in 62 subjects showed 31 perfect results, 35 passable, and in 13 secondary atrophy; in some of the latter there was no trace of a testicle. He opposes the removal of the testicle during an operation for hernia.

Tumors of Testicle. Coley¹ reports 18 tumors of the testicle—17 sarcomata, 1 teratoma. In 9 of these cases there was a distinct history of recent injury; 11 subjects were between nineteen and thirty years of age, 5 between thirty and forty, and 2 over forty. Involvement of the inguinal and retroperitoneal glands occurs so early that a cure of sarcoma is seldom achieved. Coley advises early operation and injection of the toxins of streptococcus and bacillus prodigiosus later.

Conservative Operation on Testicle. Pascale² demonstrated, first on animals and then on four patients, that after the removal of the (tuberculous) epididymis and vas deferens, the testicle, joined to its fellow by removing the intertesticular septum, retains its integrity; the patient has, therefore, the benefit of its internal secretion.

Mancaire³ has grafted an atrophic testicle on its sound mate in nine cases; in eight—all adults—distinct rejuvenation of the wasted organ occurred, evidenced by increased bulk and consistence.

True Hermaphrodite. Garre⁴ operated a subject, aged twenty years, who had large breasts and menstruated regularly. He found a rudimentary ovary and tube on one side, a testis and epididymis on the other; the ovarian and testicular structures were demonstrated by the

¹ Medical News, June 25, 1903.

² Riforma medica, 1903, No. 23.

³ Annales des mal. des org. gén.-urin., 1902, No. 20.

⁴ Deutsche med. Wochenschrift, 1903, No. 29.

microscope. He states that this is the first case of true hermaphroditism on record demonstrated in the living subject.

Cryptorchidism. Anthony¹ observed two natural eunuchs, possessing no discoverable testes and rudimentary penes.

Glycogen in Testicle. Loeper and Esmonet² assert that glycogen is a normal ingredient of the cells of the testis in men and dogs; it is not found in these structures of the guinea-pig and rabbit. It disappears after ligation of the spermatic artery, but persists after ligation of the vas deferens, though spermatozoan production ceases after the latter injury.

Adrenalin in Treatment of Urethral Stricture. Bactrine³ advises the instillation into the vicinity of a urethral stricture of adrenalin solution, 1 : 1000; by reducing the swelling of the strictured part it facilitates the passage of instruments. The reviewer sometimes uses adrenalin combined with a few drops of a 2 per cent. cocaine solution, whereby the shrinkage of swollen tissue is increased and anæsthesia secured. The cocaine must be used in small quantity and with caution anywhere in the urethra.

Urethral Valves. Breuer⁴ observed a case of polyuria, which had lasted for several years, in a boy aged fifteen years at the time of observation; there was no diabetes. Death occurred from uræmia. The necropsy revealed dilatation and hypertrophy of the bladder, dilatation of the ureters and kidney pelves, and chronic nephritis. The obstruction to urination was found in a fold of mucous membrane of the urethra, so arranged that it opposed the exit of urine, but offered no obstacle to the passage of a sound from without.

In a second case, a boy aged eighteen years had exhibited polyuria for several years; he sustained a dislocation of the hip, the reduction of which required anæsthesia.

A few days thereafter he became anuric and died. The post-mortem examination showed a duplicate of the former case so far as the obstructive changes in the bladder, ureter, and kidneys were concerned; the urinary obstruction was found in a diaphragm-like fold of mucous membrane in the urethra, which was thrown nearly across this channel by the urine emerging from the bladder, but was easily passed by a sound coming from the meatus.

Such strictures have been repeatedly observed, and would doubtless be more frequently recorded were the urethra opened as a routine procedure in post-mortem examination.

¹ Journal of the American Medical Association, August 2, 1903.

² Bull. de la soc. anatom., June, 1902.

³ Annales des mal. des org. gén.-urin, 1903, No. 11.

⁴ Semaine médicale, 1903, No. 7.

High Operation for Varicocele. Thornburgh¹ reports thirty-three personal and forty-four other cases of this operation, with perfect results. The finger-tip is pushed into the external ring, and the skin is nicked over the end of the finger. An incision 3 c.c. long is made parallel to Poupart's ligament, beginning at the nick in the skin and dividing the deep fascia; by blunt dissection the cord is exposed, and all structures except the vas deferens are ligated; one need not spare the spermatic artery nor a single vein. Two ligatures are applied and the tissues are divided between them.

Improved Carbolic Acid Treatment for Hydrocele. Bodine² irrigates the sac with salt solution before introducing the acid, in order to remove the hydrocele fluid, whose albuminous constituent combines with carbolic acid, preventing the caustic effect of the latter on the lining of the sac. After thoroughly removing the contents by this irrigation (he advises two punctures, at the top and bottom of the sac, respectively) he introduces one or two drachms of liquefied carbolic acid crystals, manipulates the sac so as to bring the acid in contact with the entire lining, and then removes the acid by thorough irrigation (he might also neutralize it by alcohol).

Urethroplasty. Berg³ discusses plastic repair of the urethra, laying stress upon the well-demonstrated ability of the urethral epithelium to proliferate along freshly divided tissues. He thinks that a defect to be successfully repaired should not exceed 3 cm. in length, and that the stumps must be freely mobile—that is, not embedded in cicatricial tissue.

Amputation of Penis. Hopmann⁴ mentions five cases in which Bardenheuer's method of treating the urethral stump has been successfully used. The urethra, completely detached from surrounding tissues, is cut so as to leave 2 cm. of it projecting from the cut surface, the skin being sutured to its base without including the mucosa. During the healing process the edges of the new urethral orifice curl outward, leaving a wide orifice incapable of strictural contraction. One of Hopmann's cases was operated on nine years before the report, and is free from any suggestion of stricture.

Chronic Cavernitis. The chronic circumscribed obliteration of the venous spaces of one or both corpora cavernosa, when not due to syphilis, is a condition generally considered rare, but possibly merely rare of recognition. Galewsky and Hübener⁵ review the scanty literature and discuss this question without adding materially to our knowledge. They advise excision of the indurated portions, on the plea that the resultant scar will be smaller—and therefore less obstructive to satis-

¹ *Medical News*, August 29, 1903.

² *Ibid.*, March 21, 1903.

³ *Annals of Surgery*, 1903, p. 486.

⁴ *Centralblatt f. Chirurgie*, 1903, No. 22.

⁵ *Münchener med. Wochenschrift*, 1902, No. 32.

factory erection—than the tissue removed. I would advise either the administration of thiosinamin by mouth or by subcutaneous injection, for several months; I have seen material improvement, rendering other measures unnecessary, in at least two cases.

Double Penis. Volpe¹ observed an infant with atresia ani, which died twenty-nine days after birth. It possessed a double penis, urethra, scrotum, and bladder, but only a single kidney, ureter, and testis.

Physiological Albuminuria. Leube² has made a new series of researches on one hundred soldiers. He asserts, on this basis, that the night urine of the subjects of albuminuria, without discoverable renal lesion, contains only about half as much albumin as the day urine; the excess during the day is due to the venous distention caused by the upright position. He further states that only nucleo-albumin appears in the urine after light exercise, the serum albumin and globulin escaping through the kidneys after severe muscular effort.

Singer³ narrates a case in which the patient's urine contained albumin only after the subject lay for some time on the left side. He had an enlarged spleen, and by the pressure of this upon the left renal vein Singer explains the phenomenon. The same observer asserts that severe exercise (such as cavalry drill) may produce not only albuminuria, but also hæmaturia, in subjects free from renal disease, present or remote.

Cyclical albuminuria occurs in neurotic, otherwise healthy young people.

I have discovered albuminuria, without other evidence of renal disease, in two apparently healthy young men who were on the eve of marriage. Upon their return from their respective wedding journeys their urines were free from albumin, and so remained during several months of observation.

Albuminuria from Spermaturia. Elliot⁴ finds that the albumin reactions are sometimes produced in the urine by seminal fluid contained therein. Of 1000 male urines, spermatozoa were present in 56; 44 of these gave the usual reactions for albumin. In 20 of the latter no other explanation of the albuminuria was found than the admixture of seminal fluid. (It is of course possible that the albuminuria was of renal origin; the two cases of temporary albuminuria before marriage, above mentioned, showed albumin when spermatozoa were absent, and none after marriage, though spermatozoa were sometimes included.)

¹ *Annales des mal. des org. gén.-urin.*, July 1, 1903.

² *Therapie der Gegenwart*, October, 1902.

³ *Prager med. Wochenschrift*, October 9, 1902.

⁴ *New York Medical Journal*, June 13, 1903.

Simple Test for Albumin in Urine. A drop of albuminous urine in a little distilled water produces a distinct opalescence, like cigar smoke; this is said to be very delicate, and quite reliable because not produced by any other urinary ingredient.

Hay's Test for Bile Acids. A pinch of flour of sulphur floats for an indefinite time on urine free from bile (when not above room temperature), but sinks immediately when even one drop of bile is added to a quart of urine. Freshly passed normal urine does not float the sulphur, because too warm.

Physiological Spermatorrhœa. Miliam and Mamlock¹ usually found living spermatozoa in the urine of seven out of eight healthy young men about twenty years old, whose urines were frequently examined. The spermatozoa were usually absent for a few days after coitus. The authors regard the phenomenon as the result of a physiological overflow of the seminal secretion.

Treatment of Phosphaturia. Soetbeer² found, in a case of phosphaturia with intestinal disturbance, that the urine contained nearly four times as much lime as in health. His explanation is that the large intestine—the natural excretory organ for calcium salts—was unable, by reason of disease, to excrete the lime; hence its passage through the kidneys. The rational therapy for such phosphaturia is the medication of the large bowel.

Etterlen³ has seen great improvement in about thirty cases of phosphaturia from the internal administration of calcium sulphate and magnesium carbonate, 20 to 30 grains of each daily.

Solution of Uric Acid by the Administration of Calcium Salts. Croftan⁴ advises the use of calcium salts (*e. g.*, the carbonate, 15 to 20 grains three times daily) as a prophylactic and solvent for uric acid calculi. He has used it with evident advantage in four such cases. The lime combines with phosphoric acid and is eliminated by the bowel, leaving a smaller proportion of the acid for the usual combination with the sodium base; hence there results a larger excretion by the kidneys of disodium phosphate (in which uric acid is soluble) and a smaller portion of monosodium phosphate (in which uric acid is insoluble).

Urachus Infections. Hind⁵ reports three cases of *abscess of the urachus*, with a discharge of pus from the navel; in two (girls, aged four and six years respectively) the urachus was successfully curetted

¹ Bulletin de la Société anat. de Paris, 1902, p. 607.

² Jahresbericht f. Kinderheilkunde, Band lvi.

³ Journal des praticiens, 1902, p. 716.

⁴ Journal of the American Medical Association, March 28, 1903.

⁵ British Medical Journal, July 26, 1902.

and drained ; in the third case, an elderly man, the abscess broke spontaneously into the bladder.

Dugan¹ opened and curetted an abscess of the urachus in a girl aged four years. The urine remained normal, but retention requiring the catheter existed for six days.

Yohimbin as an Aphrodisiac. Lewitt² gives a summary of all the recorded experiences with this drug, and decidedly advocates its use as an aphrodisiac. It is evident, however, that yohimbin has no curative influence on the local lesions of the genital organs which so commonly underlie impotence, and that its only successes may be expected where the psychical is the chief factor in the impairment of sexual vigor ; hence the indiscriminate prescription of this drug in all cases of impotence results in an overwhelming majority of failures. Such is the general experience, including my own.

Loewy,³ the original and enthusiastic advocate of yohimbin as a cure for impotence, describes it also as a *local anæsthetic*, its action almost paralleling that of cocaine.

Haiké⁴ says that yohimbin with suprarenal extract is an ideal local anæsthetic, possessing all the merits with none of the disadvantages of cocaine.

¹ St. Paul Medical Journal, November, 1902.

² Deutsche med. Wochenschrift, 1902, Nos. 47 and 48.

³ Münchener med. Wochenschrift, 1903, No. 15.

⁴ Therapie der Gegenwart, 1903, No. 5.

DISEASES OF THE KIDNEYS.

By JOHN ROSE BRADFORD, M.D., F.R.C.P.

The Blood in Chronic Renal Disease. Our views of the treatment of chronic renal disease must be greatly influenced by the effect of the malady on the composition of the blood. Strauss¹ has conducted a series of observations on the changes undergone by the blood in chronic renal disease. He has examined especially the products retained in the blood and in the exudations, and the facts observed by him have a considerable bearing on the pathology of *uræmia*. Strauss divides his results into three principal groups: First, those obtained in *chronic parenchymatous nephritis*; second, those in *chronic interstitial nephritis*; and, third, those in so-called intermediate cases, together with some instances of *waxy kidneys*, *congested kidneys*, and *tuberculous disease*. In all his observations he used from 100 gm. to 200 gm. of blood obtained by venesection, but, in addition, œdema fluid, the fluid of ascites, and of hydrothorax were also investigated. In a few instances the cerebrospinal fluid obtained by lumbar puncture was employed. In all these various liquids Strauss determined the quantity of nitrogen present in a non-albuminous form, the quantity of uric acid, of ammonia, the percentage of chlorides, and in some instances the quantity of sugar and the ash. The degree of toxicity and the freezing point of the liquid were also determined in some instances. Strauss also determined the quantity of nitrogen present in the form of extractives in normal conditions, and he considered that in health from 20 mgm. to 35 mgm. of extractive nitrogen are present in every 100 c.c. of serum. In so-called chronic parenchymatous nephritis the amount of nitrogen present in the serum may rise to 40 mgm., which is but a small increase above the normal. But in chronic interstitial nephritis the increase is far greater and may reach 85 mgm. In the intermediate forms the increase is much more moderate and may reach some 50 mgm. With the onset of uræmia there is a still further increase, and Strauss gives the following numbers: In uræmia complicating chronic parenchymatous nephritis from 53 mgm. to 65 mgm. of nitrogen in 100 c.c. of serum. In chronic interstitial nephritis

¹ Die Chronischen Nieren. Entzündungen, Berlin, 1902.

there may be an average amount of 129 mgm., and in the so-called intermediate cases 120 mgm. Similar results were obtained by the analysis of transudation fluids, such as pleural and ascitic fluid. The normal quantity of nitrogen in the form of uric acid is, according to Strauss, between 0.07 mgm. and 0.6 mgm. per 100 c.c. of serum, and this also undergoes a corresponding increase in the diseases under consideration, reaching the highest level in chronic interstitial nephritis, where an average of 2.9 mgm. per 100 c.c. may be present. There is a somewhat similar increase of the nitrogen present in the form of ammonia. In all cases of nephritis this is increased, but to a less extent in the parenchymatous than in the interstitial varieties. In the latter as much as 5.2 mgm. per 100 c.c. may be present. In uræmia there is also an increase in the quantity of this nitrogen. Strauss considers that in every 100 parts of nitrogen present in the blood serum 75 exist in the form of urea, 2.5 as uric acid, 5 as ammonia, and 17.5 in other and more or less unknown extractives. He does not think that there is any appreciable change in the relation of these various forms of nitrogen until the onset of uræmia. When this supervenes there is not only a great increase in the amounts of these nitrogenous bodies, but there is a greater relative increase in the uric acid than in the others. Strauss does not consider that the percentage of chlorides or that the quantity of ash undergo any fixed changes in the different forms of nephritis. In his observations on the toxicity of the serum Strauss injected at a given rate of 1 c.c. to 3 c.c. per minute of the serum into the bloodvessels of rabbits, and the results obtained show that the blood serum in cases of interstitial nephritis was far more toxic than that obtained in chronic parenchymatous nephritis; in fact, in the latter the toxicity of the serum may remain almost at its normal level. Strauss also discusses the specific gravity, the total solids, and the quantity of albumin in the blood. According to his results the specific gravity is low in cases of chronic parenchymatous nephritis, and the amount of albumin is also less than normal. On the other hand, in chronic interstitial nephritis the specific gravity is near the normal, as is also the quantity of proteid.

Strauss sums up the results obtained in chronic parenchymatous nephritis and chronic interstitial nephritis somewhat as follows: In chronic parenchymatous nephritis there is no increase in the amount of retained nitrogen; the proportion of salts present is either normal or but slightly increased. The specific gravity is low, and the percentage of total proteids is less than normal. The toxicity of the blood serum is either normal or less than normal. On the other hand, in chronic interstitial nephritis there is an increase in the amount of retained nitrogen, the quantity of salts present is normal, the specific gravity is either nor-

mal or but little diminished, and the total quantity of proteids present in the blood is also normal. The toxicity of the serum, however, is considerably increased. As a result of comparing these results, Strauss concludes that the pathological processes in the two forms of the disease are somewhat similar in that in both there is evidence of retention of urinary products, but he considers that it is possible that the nature of the retention may be different in the two cases, and certainly the manner in which compensation is established in the two conditions is undoubtedly different. In chronic parenchymatous nephritis the danger that might result to the organism from the retention of urinary products is neutralized or diminished, according to Strauss, owing to the fact that the retained products are diluted in the blood current by an increase in the amount of the circulating fluid. In chronic interstitial nephritis this hydræmia is also present, but the increase in the amount of the circulating fluid is much less owing to the presence of cardiac hypertrophy. Strauss considered that this cardiac hypertrophy is a compensating mechanism, and that this, together with the remains of healthy kidney substance, brings about the excretion of the large quantities of urinary water. Strauss considers that in a number of instances the force of the heart has been sufficient to diminish the hydræmia by bringing about a copious excretion. This author lays stress on the fact that in uræmia there is an increase in the molecular concentration of the blood, and also often a considerable increase in the amount of retained nitrogen ; and he thus agrees with the conclusions advanced by others that uræmia is the result of a chemical intoxication and is in no way dependent on purely physical causes. Strauss considers that in the treatment of renal disease the most important procedure is to try and eliminate the toxic matters present in the blood and tissue fluids. With this object the aim of the physician should be to increase the cutaneous and salivary secretions and to promote in all possible ways elimination from the intestines. He also considers that the subcutaneous œdema fluid should be removed by puncture, and that all pleural and ascitic collections should be similarly treated. Venesection is especially useful, and most of all in chronic interstitial nephritis. He considers that venesection should be employed as soon as there are any symptoms, however slight, of uræmia, and that it is a great mistake to delay until the onset of marked and obvious uræmia. The venesection should be frequently repeated, and he thinks it is also useful as a preventive to the onset of uræmia. Finally, he does not consider that venesection is ever harmful. Strauss' results would seem at first sight to show a profound difference between so-called parenchymatous and so-called interstitial nephritis. But, as he himself points out, the differences are more apparent than real, and are to be

correlated with the presence of dropsy in the one disease and its absence in the other. The dropsical exudation of renal disease removes large quantities of toxic material from the blood, and this mechanism is more or less absent in chronic interstitial nephritis, where the sole channel of elimination is the urine. Strauss looks upon the accumulation of nitrogenous extractives in the blood as entirely due to retention. This, in the opinion of the writer, is more than doubtful both in the light of physiological and pathological observations. In cases of chronic interstitial nephritis, where the retention is most marked, the patient frequently excretes quantities of urea quite comparable to the normal, and yet notwithstanding this the quantities present in the blood may largely exceed the normal. Further, these maladies are often accompanied by very marked wasting, and it is very probable that the great increase in the nitrogenous extractives of the blood and tissues is in part, if not in the main, dependent on a primary disintegration of the proteid tissue of the body. These conclusions are of interest from a theoretical point of view, but from a practical therapeutic standpoint are not of much importance, since the retention of urinary products must be treated by measures directed to promote vicarious elimination, whether the retention be a simple one or in part dependent on increased production of nitrogenous extractives or other toxic substances.

Achard and Loeper¹ have made a series of observations on the effect of the suppression of the renal functions on the quantity and distribution of the water present in the organism. The results have a bearing not so much on the pathology of dropsy as on the alterations of the blood state in renal disease. In all their experiments the functions of the kidney were arrested by ligature of the vessels in the hilum. Subsequently to this the amount of water lost by the intestine and by the lungs was determined. Observations were also made on the quantity of blood, and the proportion of water in the blood and tissues. As a result of their experiments it was found that the volume of the blood was very distinctly increased. This was determined by observing the number of red blood corpuscles in a cubic millimetre. It was found that even twenty-four hours after operation a very appreciable increase in the volume of the blood had occurred. Along with this there is also a notable increase in the amount of water in the blood. They draw attention to the at first sight curious result that the blood becomes richer in water notwithstanding the fact that the molecular concentration is shown by cryoscopy to be increased. This apparent contradiction is really dependent, of course, on the excretion normally in the urine of a number of salts, and thus, together with the dilution of the

¹ Archives de médecine expérimentale, January, 1903.

blood owing to the retention of water, there is also an alteration in the relative amounts of proteids, extractives, and salts. The suppression of the renal function does not affect the quantity of proteid matter present in the blood, and in addition to the increased amounts of water present there are increased quantities of extractives and salts. Thus, although there is a considerable increase in the volume of blood, the percentage of chlorides remains approximately normal, whereas the percentage of proteid matters diminishes as the volume of the blood increases. The blood may even become hypertonic, although it is hydræmic. In addition to the increase in the proportion of water present in the blood there is also an increase in the amount of water in the tissues. Thus, muscle was found to contain some 72 per cent. to 74 per cent. of water in the controls, whereas after the ligature of the renal vessels the percentage of water present varied from 74 to 78. There is in addition a very great increase in the quantity of water excreted. Thus, in the controls the excreta contained from 42 per cent. to 69 per cent. of water. After the operation the quantities varied between 46 per cent. and 80 per cent. The amount of water excreted by the lungs was increased by approximately one-third after the operation. All these results show the very considerable quantity of water that is retained in the organism after the suppression of the renal functions. Another fact proving the same conclusion is that the loss of weight subsequent to the operation is far less than in a control animal, both being kept without food and under similar conditions. The authors not only observed these facts as regards the distribution of water, but they also made observations on the effects following the injection of saline solutions subcutaneously and into the circulation of these animals, and their results are of some interest. They find that isotonic and hypotonic solutions only produce very transitory and slight effects on the volume of the blood, and in this respect the effects are similar to those seen with normal animals. This result is doubtless dependent on the absence of any great difference between the concentration of normal blood and that of isotonic or hypotonic solutions, and hence the injection does not materially add to the volume of water present in the circulation. On the other hand, the injection of hypertonic solutions may produce marked effects owing to the degree of concentration employed. In the normal animal the injection of a hypertonic solution increases notably the volume of the blood, and this effect is also seen after ligature of the renal vessels. The effect is so marked that it is not dependent on the mere volume of the liquid injected, and further proof of this is afforded by the fact that the result is only marked some twenty to thirty minutes after the injection. In some instances this increase in the volume of the blood, after intraven-

ous hypertonic injection, is so considerable as to cause death, and, in fact, after ligature of the renal vessels only very small quantities of hypertonic solutions can be injected into the blood stream. After these hypertonic injections the quantity of water lost from the lungs is still further increased; nevertheless, the amount of water in the blood also becomes increased. If the hypertonic solution is injected subcutaneously instead of intravenously precisely opposite phenomena ensue. The volume of the blood becomes diminished and the quantity of water excreted by the lung is also diminished. But there is an increase in the quantity of water in the tissues, whereas when the hypertonic solution was injected intravenously the water contents of the tissues became less. In other words, there is a close relationship between the quantity of water in the tissues and the amount present in the blood. The increase in the volume of the blood after intravenous hypertonic injections is a protective mechanism, the water passing from the tissues to the blood and diluting the high percentage of salts present. The results of these authors are of considerable interest as showing the delicate nature of the balancing arrangement between the blood and the tissues, and showing how by the suppression of the renal functions composition of the blood and of the tissue juices is profoundly altered.

Hypertrophy of the Kidneys in Cirrhosis of the Liver. Renal lesions are often present in diseases of the liver, and they doubtless owe their origin to a variety of causes.¹ Thus, the agent causing the hepatic disease may also give rise to the renal lesion; but recently a number of French authors have considered that the renal lesions associated with hepatic disorders are dependent directly on the hepatic disease itself. Mollière published a series of cases of acute and chronic nephritis occurring in the course of diseases of the liver, chronic nephritis being more common than acute. He considered that these renal lesions owed their origin to the action on the kidney of toxic products in the blood, which, owing to the liver disease, were not destroyed as they normally would be; and that it was established that genuine Bright's disease might arise in this way without the action of any other factor. Teissier also considers that some varieties of albuminuria may really be of hepatic origin. Hypertrophy of the kidney has been observed in biliary cirrhosis or the cirrhosis of Hanot. Mollard records thirteen cases of alcoholic cirrhosis of the liver in which renal hypertrophy was present in varying degrees. In nine cases the hepatic cirrhosis was of the ordinary type, produced the ordinary symptoms, and was recognized during life. In the other four cases the hepatic cirrhosis was of the latent type, and was observed in

¹ Lyon médical, November, 1902.

the post-mortem room in cases where death had resulted from other diseases. In the nine cases the malady was advanced, and all of the patients died within one to two months after admission to the hospital, and death was entirely dependent on the hepatic disease, and in almost all instances albuminuria was absent. In only one case where febrile jaundice was present in addition did the urine contain any albumin. The absence of albuminuria proved the absence of nephritis, although occasionally interstitial nephritis in an early stage may exist without albuminuria. On examination, however, no such lesion was present; the kidneys were large, regular in shape, and in some instances were twice the normal weight. More often the increase in weight was more moderate and amounted to an increase of one-half the normal. There were no marked lesions in these hypertrophied kidneys with the exception of a certain amount of venous congestion and some granular degeneration of the epithelium of the convoluted tubules. No glomerular changes, no sclerosis, nor any leucocytic infiltration were found. In four other cases the hepatic cirrhosis was only discovered in the post-mortem room. Two of these were cases of delirium tremens, and the other two cases of advanced and generalized arterial disease. In three the kidneys were healthy, and did not present any appreciable hypertrophy. In the fourth an advanced condition of the granular kidney was found. Mollard considers that in hepatic cirrhosis the kidneys are either healthy or hypertrophied, and he regards the latter as the more common. These conclusions are not in complete accord with the views of other writers on this disease. Lancereaux considered that the kidneys in hepatic cirrhosis were often adherent to their fatty capsule, but otherwise did not present marked changes. He described them as of normal volume, and as slightly injected unless albuminuria was present, in which case the epithelium had undergone granular degeneration. He further considered that the kidneys were usually unaffected in hepatic cirrhosis. Rendu, Wallmann, and Handfield Jones all held the contrary opinion, and considered that renal fibrosis was a very common accompaniment of hepatic cirrhosis, and most recent writers have associated interstitial nephritis with hepatic cirrhosis. Dickinson, in fifty cases of hepatic cirrhosis, found the kidneys granular on eight occasions, and Grainger Stewart, in 100 cases of granular kidney, found fifteen instances of cirrhosis of the liver. The authors who have described the presence of the granular kidney in hepatic cirrhosis have always associated both lesions with alcohol. It would certainly seem, both from Mollard's observations and from the older records, that advanced renal disease is not so often correlated with hepatic cirrhosis as some authors have thought, and that even albuminuria and other functional derangements of the kidney are also relatively uncommon.

Where advanced renal lesions are present they certainly take the form of interstitial nephritis in varying degrees of severity. Mollard considers that the increase in the size of the kidneys found by him is dependent on the hypertrophy due to an increase in the functional activity of the organ. This increased activity he regards as dependent not so much on the hepatic disease as on the alcoholism causing the liver changes. In other words, this author looks upon the increase in size as due to a hypertrophy produced by the diuretic action of the alcohol. Mollard ranges himself with those authors who rather discount the toxic action of alcohol on the kidneys, and he considers that the pathological action of alcohol on the kidneys is by no means established, and that idiosyncrasy must play a great part in the development of renal lesions in alcoholism. On the other hand, he considers it fairly established that in many instances the kidneys are refractory to alcohol. Most physicians will certainly agree with the conclusion that alcohol may cause extensive lesions in other organs without necessarily implicating the kidneys. Thus, advanced hepatic cirrhosis and even cardiac diseases dependent on alcohol and associated with hepatic disease may exist without the presence of albuminuria. Mollard points out that although the kidney is sometimes refractory to the action of alcohol, yet it hypertrophies with great readiness, sometimes as a result of unilateral lesions; in other instances associated with chronic nephritis, and, thirdly, as a result of increase of function, as in diabetes mellitus. Mollard also draws attention to the fact that considerable renal hypertrophy is well known to occur in heavy drinkers with or without the development of lesions in other organs, and without the presence of cardiac lesions capable of giving rise to renal changes as a result of passive engorgement. He, therefore, regards the hypertrophy described by him as dependent merely on increased function.

Internal Renal Secretion. The question of the existence of an internal renal secretion is one that still engages the attention of physiologists and pathologists, and notwithstanding the large amount of experimental work that has been done it cannot yet be looked upon as decided.¹ The question is one of great interest to the physician, owing to the bearing it has on the treatment of *uraemia*. Almost all authorities are agreed that this is of toxic origin, and the only remaining question is to determine the nature and source of the toxic agent. Three views may be said to be held with reference to this: 1. That *uræmia* is dependent on the accumulation of a toxic substance owing to deficient elimination. 2. That the toxic agent is derived from the disintegration of the tissues. 3. That this tissue disintegration is

¹ *Revue médicale de la suisse romande*, September, 1902.

dependent on the lack of an internal renal secretion. Brown-Séquard was the first to suggest an internal renal secretion, and he based his conclusions on his results that the injection of renal extract led to the prolongation of life of nephrectomized animals. Meyer arrived at the same conclusion by different experiments. He found the injection of normal blood, but especially of blood obtained from the renal vein, relieved the uræmic symptoms and especially the dyspnoea seen as a result of nephrectomy. He further observed that uræmic blood injected into healthy animals produced no effect, but if injected into nephrectomized animals uræmic symptoms were immediately produced. He concluded from these observations that uræmia might be produced by the retention of toxic substances and also by the suppression or diminution of the internal secretion of the kidneys. Teissier and Fraenkel came to the conclusion, from a study of the effects of renal extract, that this extract contained bodies capable of causing the elimination by the kidneys of toxic material present in the blood. They considered that the subcutaneous administration of renal extract led to a diminution in the albuminuria and an increase in the toxicity of the urine. Tigerstedt and Bergmann consider that the cortical substance of the kidney contains a body having a vasoconstrictor action. This conclusion has, however, not been maintained by other observers. Chatin and Guinard consider that the kidneys possess an internal secretion in the light of clinical facts, and especially the well-known fact of the difference in the symptoms in obstructive suppression and the anuria of acute nephritis. In my opinion, the argument in favor of an internal renal secretion cannot be based on the alleged difference in the symptoms of calculous and other forms of obstructive suppression on the one hand, and those seen in non-obstructive suppression on the other. The symptoms characteristic of calculous anuria are also seen in cases of suppression of the functions of the kidneys produced by vascular lesions—*e. g.*, renal thrombosis; or even by toxic causes, as in diphtheritic suppression. In fact, the symptoms of calculous anuria are really the symptoms of the suppression of the functions of the healthy kidneys. Clinical medicine proves that the suppression of the functions of the human kidneys produces not ordinary uræmia, but the symptoms associated with obstructive or calculous suppression. Vitzou is the author who has adduced most of the recent facts in favor of the existence of an internal renal secretion, and his observations were made especially with defibrinated blood or the serum of the renal vein. Vitzou found in a series of control experiments that nephrectomized rabbits died in from sixteen to thirty-four hours after the nephrectomy, whereas those treated with the defibrinated blood of the renal vein survived from sixty to sixty-nine hours

after double nephrectomy. Dogs after double nephrectomy survive from twenty-four to forty-seven hours, and in one instance seventy-one hours. But if treated with the serum of the renal vein these animals live from one hundred and eight to one hundred and twenty-seven hours, and in one instance one hundred and sixty-four hours after the operation. Vitzou considers that the internal secretion of the kidney produces an antitoxic-like effect neutralizing the toxins which are produced in the body and are accumulating in the blood as the result of the nephrectomy. Vitzou attaches great importance to the nephrectomy being performed in two stages, the second kidney being removed one or two months after the first, and thus obviating the very great shock caused by double nephrectomy.

Stern has reinvestigated this subject and made a series of observations on guinea-pigs, rabbits, cats, and dogs. In the first series of observations the nephrectomy was done in two stages, and in the case of guinea-pigs they were treated with subcutaneous injections of watery extract of the kidney. The animals treated, however, did not survive longer than the controls. A second series of observations was made in which the ureters were ligatured in the hope that in this way the internal secretions might be retained. These animals, however, did not survive any longer than the control in which double nephrectomy had been performed. This result of Stern is quite in accord with those obtained by all workers at this subject, and it must be admitted that neither experimentally nor clinically is there any profound difference between the results following obstruction of both ureters and those seen after complete nephrectomy. Stern made a further series of experiments in which after nephrectomy an indifferent fluid, such as 0.8 per cent. NaCl, was injected instead of renal extract. In some instances controls were also made in which equivalent quantities of renal extract were injected. The results of these observations were somewhat variable, but in many instances the animals treated with the physiological salt solution survived for very considerable periods, in one case sixty-five hours, whereas those treated with renal extract lived only sixteen and seventeen hours. In the case of rabbits somewhat similar results were obtained. The animals treated with the artificial serum survived longer than either the controls or those treated with renal extract. Further, a more prolonged survival was seen in the animals that received the largest injections. Thus, in one instance ten injections of the salt solution or artificial serum were made, amounting to 95 c.c., and the animal survived for seventy-eight hours, the longest duration of life in the control being sixty-two hours. In the case of cats the injections of renal extract or of the blood of the renal vein was not so beneficial as the injection of considerable quantities of the

artificial serum. Prolongation of life, however, was not very marked, namely, seventy-eight hours, in contrast to sixty in the case of the control, where double nephrectomy had been performed, but no treatment of any kind carried out. A few observations of a similar character were made on dogs, and, according to Stern, these animals will survive periods of ninety to one hundred and thirty-two hours after nephrectomy if they are treated with these injections of physiological salt solution. Control animals always succumb in from twenty-four to seventy hours. One animal treated with the blood of the renal vein survived for eighty hours. It would thus seem that the treatment with the saline injections was the most successful. Stern draws attention to the fact that when diarrhœa and vomiting are marked symptoms life is more likely to be prolonged, and this is in favor of the view to some extent that uræmia is the result of the retention of toxic substances. Stern considers that the experiments quoted above do not afford any evidence in favor of the existence of an internal renal secretion, and that on the whole after double nephrectomy the hypodermic injections of this artificial serum afford a more efficient means of prolonging life than either the renal extract or the blood of the renal vein. On the other hand, the beneficial effect of these injections of salt solution has not been constant, and in some instances the control animals have survived for longer periods than some of the treated animals. Stern looks upon these results as dependent on idiosyncrasy, and on a variable degree of resistance of individual animals to toxic agents. The beneficial effect of the injections of salt solution may very probably be dependent on mere dilution of the toxic substances in the blood, and it is possible that, thanks to this dilution, they may be eliminated more readily by other channels—*e. g.*, the bowel. This explanation is possible, as the best results were obtained where the largest quantities of salt solution were injected and where diarrhœa and vomiting were marked symptoms. These observations of Stern are mainly of interest from the theoretical point of view, as affording evidence against the existence of an internal renal secretion. But in addition to this they afford definite support to the use of saline injections in the treatment of uræmia, a mode of treatment which is well known to be beneficial in many instances. The use of saline injections has been mainly confined to the treatment of acute and chronic uræmia arising in the course of advanced renal disease; but a further use of this method might be made in the light of Stern's results. It is well known that in the human subject life may be prolonged for many days, even a week, in cases of complete calculous suppression, and sometimes it is possible that the use of saline injections in this grave condition might be of use so as to prolong life and enable successful surgical measures

to be taken. As mentioned above, there is no reason for thinking that the effects from ligature or obstruction of the ureter are in any way different from those produced by double nephrectomy, and, further, in some of Stern's experiments ligature of the ureters was used instead of double nephrectomy. It would, therefore, certainly seem that copious saline injections might be used with advantage in the treatment not only of acute and chronic uræmia, but also in the latent uræmia occurring in calculous and other forms of obstructive suppression.

Changes in the Urine in Hepatic Disease. Analysis of the urine is of importance in medicine not only as affording information as to the functional activity of the kidneys, but also as a means of determining the functional activity of other organs and perhaps especially that of the liver. Ingelrans and Déhon¹ discussed the significance of certain changes in the urine as a means of affording information as to the functional activity of the liver. The phenomena they investigated were: 1. Alimentary glycosuria. 2. The diminution in the excretion of urea. 3. The increased excretion of ammonia. 4. The presence or absence of urobilin. 5. The significance of the presence of indican. They compared the excretion of all these substances in sixteen cases of hepatic disease with three control observations in three healthy subjects. The cases of hepatic disease were divisible into two groups, the first consisting of cases of cancer, cirrhosis, and waxy disease where the presence of gross organic disease necessarily diminished the functional activity of the liver. In the second group of cases, consisting of catarrhal jaundice and congestion of the liver, the diminution in the functional activity might be absent or only temporary. It would seem that the diminution in the functional activity of the liver does not necessarily implicate to an equal degree all its known functions, and it would seem that in disease there may be a considerable disassociation of function, so that an organ that is not capable of manufacturing quantities of urea equal to the normal may yet be able to store up sugar. Further, the authors point out that owing to the quantity of hepatic substance being greater than that necessary to maintain life, it is possible that even in advanced disease a given function of the liver may be only diminished and not abolished. In the observations on alimentary glycosuria care was taken to eliminate the fallacy of the patient suffering from glycosuria. Further, the authors always administered glucose in their test-meal, and not saccharose. Very considerable differences of opinion have been held with reference to the activity of the glycogenic function of the liver in organic diseases of this organ. Van Noorden considers that glycosuria is only rarely

¹ Archives de médecine expérimentale, March, 1903.

present even in the gravest hepatic diseases. Rendu states that even in cirrhosis alimentary glycosuria is often absent.

Strauss, in observations on thirty cases of hepatic disease, has never observed alimentary glycosuria, and in this opinion Valmont and Bloch agree with him. On the other hand, Hanot considers that the presence or absence of alimentary glycosuria is a most valuable indication of the functional activity of the liver in diseases of this organ.

Chauffard, Gilbert, and Carnot agree with Hanot and think the method of great value owing to its great simplicity, and, further, that the sugar function of the liver is the most important of all its functions, and, in fact, they regard the others as almost negligible from this particular standpoint. Achard and Castaigne have shown that there are numerous fallacies in estimating the presence or absence of alimentary glycosuria after a meal rich in sugar. These errors arise especially from variations in the rate of absorption from the intestine, and also the rate of elimination, which may vary greatly. Further, even such questions as the degree of concentration of the sugar solution used and the meal with which it is given all affect the degree of glycosuria liable to be produced. Further, a given quantity of glucose given at once may cause glycosuria, whereas the same quantity administered in divided doses may lead to no such result. The present authors, in order to avoid most of these fallacies, administered to their patients 150 gm. of pure glucose dissolved in 300 gm. of distilled water. This quantity of sugar was given on an empty stomach, and was taken in fifteen minutes, and no other fluid was given for three hours afterward. The urine was tested with Fehling's solution, the bismuth test, and the polarimeter. In the three control observations on healthy persons no glycosuria was present, and only two among the sixteen cases of hepatic disease presented it. In one case of cardiac cirrhosis, verified at the autopsy, the patient was only able to take 50 gm. of glucose and only traces of it were found in his urine. In the other instance, a case of hypertrophic cirrhosis and fatty liver, 0.7 gm. of glucose was excreted in the twenty-four hours. The results, therefore, were almost in all cases negative, and in one instance, of atrophic cirrhosis, this was so, notwithstanding the fact that the liver weighed only 330 gm. (10½ oz.). In another instance no glycosuria was present, notwithstanding that the liver tissue was almost entirely replaced by secondary malignant growths. The authors are inclined to agree with Van Noorden that in extensive organic diseases of the liver alimentary glycosuria only occurs exceptionally, and that this is to be regarded as due to the considerable number of hepatic cells that remain fairly normal even in cases of advanced cirrhosis and cancer.

Increased Excretion of Nitrogen. In the great majority of cases of gross organic diseases of the liver a considerable diminution in the quantity of urea excreted may be observed. A more accurate method is probably the one that deals with the relation of the quantity of urea to the total nitrogen rather than one dealing with the mere amount of urea. These authors observe not only the quantity of urea, but also the total nitrogen excreted and the amount of ammonia. The diminution in the quantity of urea is often very great. In one case of atrophic cirrhosis only $3\frac{1}{2}$ gm. (52.5 gr.) were excreted in the twenty-four hours; in another a little over 7 gm. (107 gr.). In a case of catarrhal jaundice $18\frac{1}{2}$ gm. (277.5 gr.), and in other instances of cancer and in various types of cirrhosis quantities of 18, 19, and 20 gm. (270, 285, 300 gr.) Thus, in all instances the total quantity excreted was considerably below the normal. Under normal circumstances approximately 85 per cent. of the total nitrogen excreted passes out in the form of urea. In cardiac cirrhosis, cancer of the liver, and atrophic cirrhosis as little as 46 per cent. of the total nitrogen may be excreted as urea. This result, however, is not constant, and in one of the author's cases of cardiac cirrhosis as much as 96 per cent. was present in the form of urea, but this is quite exceptional, and in the great majority of cases there is a very considerable diminution, and it is possible that this may be of considerable clinical importance. The diminution in the relative and absolute amounts of urea excreted may depend in part on inanition as well as on an incapacity of the hepatic cells to elaborate urea. Further, it must not be forgotten that an acid intoxication of the tissues may play a very considerable part in causing some of the nitrogen to be excreted in other forms than urea, as in all acid intoxications ammonia is used to neutralize the acids formed. Under normal circumstances from 2 per cent. to 5 per cent. of the nitrogen excreted is in the form of ammonia. In many hepatic diseases this quantity is considerably increased, and in acute yellow atrophy it may even reach the amount of 70 per cent. Ingelrans and Déhon confirm the results of previous observers, and they find that in all instances of organic and even of functional derangements of the liver the quantity of nitrogen excreted in the form of ammonia is notably increased, and in some instances of atrophic cirrhosis may reach the high level of 16 per cent. of the nitrogen excreted. A further method of testing the efficiency of the liver in dealing with nitrogenous metabolism is afforded by the administration of acetate of ammonia. In healthy conditions this substance is excreted in the form of urea, but in hepatic diseases some of it may pass out as ammonia. The authors found that in seven cases the administration of acetate of ammonia was followed by an increase in the amount of ammonia

excreted. In five cases the opposite result was obtained, and in four no effect at all was produced. Where the administration led to an increase in the quantity of ammonia excreted this increase was often extremely marked. In one case of atrophic cirrhosis six times as much ammonia was excreted after the administration of ninety grains of acetate of ammonia. These results are of interest in showing how the liver cells have lost their power of converting ammonia salts into urea, and it is possible that this method might come into more general use as a means of testing the functional activity of the liver.

Indicanuria is not uncommonly present in a number of hepatic diseases, but its presence or absence is rather to be associated with intestinal disturbance often secondary to the primary hepatic mischief. Hence, indicanuria is by no means always present even in cases of advanced hepatic disease, such as atrophic cirrhosis.

The excretion of urobilin in large amounts has long been associated with serious organic diseases of the liver, and Hayem goes so far as to say that urobilin may be looked upon as the urinary pigment of a diseased liver. Among the author's sixteen cases *urobilinuria* was found ten times and frequently in cases of atrophic cirrhosis. *Urobilinuria*, however, was absent in one case of cancer of the liver, and in two cases of cardiac cirrhosis.

The authors draw attention to the important conclusion that in disease there may be a disassociation of the several functions of the liver, and that consequently one must not expect in any given disease to find all the functions of the organ equally impaired. In the cases of serious organic disease—cancer, waxy degeneration, cirrhosis—one or other, or, indeed, several of the signs of hepatic insufficiency, were found on urinary analysis, and if glycosuria were by chance absent a diminished excretion of urea or an alteration in the percentage amount of nitrogen excreted as urea was frequently found. The authors conclude that experimental alimentary glycosuria is often absent even when the hepatic substance is profoundly diseased, and the glycogenic function of the liver may persist when other functions are very seriously affected. The quantity of urea is almost always diminished in all diseases where the liver substance is profoundly affected. The percentage of total nitrogen excreted as urea may give valuable information as to the degree of functional activity of the liver. Increased excretion of ammonia may be present, and the relative amount of nitrogen excreted in this form is often notably increased. The administration of ammonium acetate may give rise to an increased excretion of ammonia in half the cases.

Renal Cytotoxins. The question of the existence of renal cytotoxins or nephrotoxins is one that is engaging the attention of pathologists

owing to the unexpected light that the general question of cytotoxins throws on pathological problems. The extraordinary selective action of hæmolysins has led to the conception that similar products derived from other cells of the organism might possibly be concerned in the production of organic lesions of various organs of the body. This question has been especially investigated with reference to the action on the kidney of various supposed cell toxins. The existence of nephrotoxins has been asserted on the results following either (1) the injection of the renal substance of one species subcutaneously into an animal of the same or different species, or (2) the injecting into a certain species, *a*, the blood serum of another species, *b*, *b* having been inoculated with an extract of the kidney of *a*, or (3) the injection of blood derived from an animal in which the ureter has been ligatured, the blood being supposed under these circumstances to have absorbed the nephrotoxic substances from the damaged kidney. Albarran and Bernard¹ have reinvestigated the subject, and conducted experiments on all these lines. All workers at the subject are agreed that the renal substance possesses a high degree of toxicity, and in a number of cases an apparent specific action on the kidney has been observed; thus, the injection of the renal extract of the guinea-pig into rabbits produces very marked effects. Castaigne and Rathery find that the injection of the extract derived from both kidneys kills the animal in twenty-four hours, and that the extract of one kidney generally leads to death in some twenty days. Albuminuria occurs, and marked changes develop in the renal epithelium. The cells of the convoluted tubules lose their characteristic rod-like structure, and in places the protoplasm seems to undergo solution. The renal lesions, however, are not uniformly distributed, and in many parts the kidney remains unaltered. Albarran and Bernard have repeated these observations, using an extract of guinea-pig's kidney prepared with salt solution and injecting this into rabbits. They consider that an injection equivalent to two kidneys of the guinea-pig per 1000 gm. of rabbit causes death in three days. Wasting is a marked symptom, and convulsions occasionally occur. Even by giving the injections in small repeated doses every seven days it is not possible to inject more than the equivalent of one and a half kidneys per 1000 gm. of rabbit without causing death. The toxicity of the renal substance can be demonstrated in another way, namely, by the injection of renal substance into an animal from which one kidney has been excised. After such unilateral nephrectomy the injection of a small quantity of a renal extract prepared even from the same species is followed by death. A further and

¹ Archives de médecine expérimentale, January, 1903.

very striking result was obtained by injecting renal extract into animals immediately after the performance of double complete nephrectomy. After complete double nephrectomy life is prolonged usually for two to three days, but if into such an animal immediately after the nephrectomy the extract derived from the two kidneys be injected death results in thirty-six to forty-eight hours. These authors obtained the same results by injecting the serum obtained from the renal vein instead of the kidney substance. These results demonstrate the high toxicity of the renal substance, and, as the authors point out, are not very favorable to the use of the renal extract in uræmia and renal diseases.

Albarran and Bernard studied the effects produced by these injections on the kidney. They found that the renal cells became deformed, the protoplasm clear, and the nuclei small. One of the most important of their results is the fact that they also found lesions in the liver and more especially fatty degeneration. They note especially that the hepatic and renal lesions were often equally developed, and, further, that those observed in the liver were similar to the results obtained after the injection of liver extract. Where smaller and repeated doses of the renal extract had been given the lesions were less marked, but the protoplasm of the cells had become clear and in many places seemed to be dissolving. In these instances the liver also presented marked changes, especially in the fact that the liver cells became vacuolated. The fact that hepatic as well as renal lesions were produced by the injection of the renal substance appeared to the authors to demolish the theory of the special character of the renal lesions, and they conducted a series of observations in which hepatic extract was injected instead of renal. They were unable to detect any difference in the renal lesions produced on the one hand by injections of renal extract and on the other by those of hepatic extract. They conclude that the liver substance is undoubtedly very toxic and that the kidney would not seem to react specially to injections of renal extract. Albarran and Bernard also carried out a series of observations as to the action of nephrotoxic serum. Lindemann obtained a highly nephrotoxic serum by treating guinea-pigs with the extract of the kidneys of rabbits, and he obtained marked effects on the kidney by the injection of this serum. The converse experiment of injecting extract of guinea-pigs' kidney into rabbits did not yield to Schultze a highly nephrotoxic serum. Nefedieff has conducted a similar series of experiments and obtained similar results, although the renal lesions produced were not very marked, but at the same time the author considered them specific. Albarran and Bernard prepared a nephrotoxic serum from rabbits by the injection of the kidney extract of guinea-pigs. This serum so prepared is undoubtedly highly toxic, but the authors did not consider

that the lesions in the kidney produced by it were very special or extensive. Frequently the most marked effect was a scattered vacuolation of the kidney cells. They contrasted the effects of this nephrotoxic serum with a similar serum prepared by the injection of liver substance. This serum was undoubtedly not so toxic, but the renal lesions it produced were essentially similar to those seen with the nephrotoxic serum. The authors conclude that the renal lesions and the hepatic ones are really the result of a general toxic action of the serum, and are not sufficiently marked or special for them to be looked upon as in any way dependent on a specific action. Nefedieff asserted that after unilateral ligature of the ureter the blood serum of the animal required definite nephrotoxic properties, producing marked lesions in the kidney when injected into other animals. Albarran and Bernard have repeated these observations with negative results, except in one instance, and this experiment is of some interest. The kidney of the side opposite to that on which the ureter had been tied showed, on post-mortem examination, signs of marked nephritis, and the blood of this animal injected into others reproduced a similar nephritis. Albarran and Bernard conclude their paper by saying that the one unquestioned conclusion is that the renal substance is highly toxic, and that possibly that may be the reason that prevents the production of powerful renal cytotoxins. They consider that at the present time there is no positive proof of the existence of specific renal-cell poisons, and that these cannot be demonstrated either by the direct injection of kidney substance nor by observations with the so-called nephrotoxic serum, nor are they found in the blood of animals after ligature of the ureter. In all these instances the lesions produced in the kidney are slight in amount and cannot be looked upon as specific, and they do not think that there is any evidence of the existence of cytotoxins of renal origin having a specific action on the renal cells. These observations are of interest, although they are in conflict with the results of others and especially those of Lindemann. The point of interest from the pathological standpoint is the supposed existence of a special affinity of these toxins for the renal cells, and this in the light of these authors' results would at any rate seem to be doubtful, as the renal lesions produced are part and parcel of a more widespread and general toxic action.

Toxic Glycosuria. The conceptions of the origin of glycosuria¹ are becoming wider, and there would seem to be but little doubt that some varieties of glycosuria are of renal rather than of intestinal or of hepatic origin. The most notable instance of what may be looked upon as a glycosuria of renal origin is that produced by phloridzin. It

¹ Archives de médecine expérimentale, January, 1903.

seems to be clearly established that this glycosuria is accompanied by or associated with a diminished percentage of sugar in the blood; in other words, a condition of hypoglycæmia. Lépine and Maltet have apparently shown that the action of phloridzin on the kidney is a very special one, inasmuch as this substance does not cause the kidney to be more permeable for other substances, but only for glucose. Thus, the administration of a small dose of phloridzin insufficient to cause glycosuria does not produce any increased permeability to the other urinary constituents, not even sodium chloride. On the other hand, further doses not only cause a glycosuria, but also increase the permeability of the kidney for chlorides. Lépine and Maltet look upon this as evidence of a special differential action of the phloridzin, causing in the first place an increased permeability to sugar, and that the increased excretion of chlorides is correlated with the glycosuria rather than with the action of the phloridzin. There are, however, a number of other substances, as Lépine points out in a recent communication, that have an action analogous to phloridzin in causing glycosuria without appreciable hyperglycæmia. There can be no question of the importance of facts of this order in throwing light on the multiple origin of diabetes, and, further, in affording evidence in favor of the view that in some instances glycosuria, if not diabetes, may be looked upon as a renal affection. The undoubted existence of glycosuria, unaccompanied by hyperglycæmia, may be looked upon as proof that the glycosuria is dependent on increased renal permeability, the glycosuria of hepatic or intestinal origin being associated necessarily with hyperglycæmia. Cantharides dissolved in ether and injected in a dose of $\frac{1}{2}$ to $2\frac{1}{2}$ mgm. will cause glycosuria without hyperglycæmia in rabbits. This effect is only seen in small doses, as with large ones producing marked lesions in the kidney there is a diminution in the permeability of the kidney for sugar.

Bichromate of potash, in doses of 5 to 20 cgm., produces in addition to albuminuria a certain amount of glycosuria in animals, and after the larger doses as much as 0.7 per cent. of sugar may be present in the urine. The point of interest with reference to the action of bichromate of potash is the fact that the glycosuria produced may last for a very considerable time. Thus, in one instance the urine still reduced copper two and a half months after the injection of a single dose of 2 cgm. Glycosuria as a result of poisoning with bichromates has also been observed in man. Analyses of the blood in dogs after the injection of bichromate of potash has not afforded any evidence of hyperglycæmia, and, therefore, it is probable that the glycosuria is due to the increased permeability of the kidney. A number of observers, among others Rosenbach, Bouchard, have shown that sugar appears in

the urine as a result of mercurial poisoning. The intravenous injection of 3 mgm. of perchloride of mercury will cause albuminuria in the rabbit, but accompanied by a very notable glycosuria; the latter reaches its maximum some twenty-four hours after the injection. It is not clearly established, however, that the glycosuria is entirely of renal origin, as there is a conflict of opinion as to the presence or absence of hyperglycæmia. According to Richter, there is a very definite hyperglycæmia; other observers have failed to notice this. But mercury is known to produce other effects, as, for instance, the diminution or even the disappearance of the glycogen accumulated in the liver. The glycosuria produced by arsenic or phosphorus is probably of mixed origin, and is not dependent on the renal changes alone, but is to be associated with the effects produced by these drugs on the liver. The glycosuria produced by chlorate of potash is also of unknown origin, although this substance produces in large doses undoubted renal lesions. One of the most interesting varieties of glycosuria is that produced by the salts of uranium. Chittenden observed that nitrate of uranium in doses of 5 cgm. to $7\frac{1}{2}$ cgm. administered repeatedly produced albuminuria as soon as the fifth day, and that larger doses of 15 cgm. caused glycosuria without any increase in the albuminuria. A further increase in the dose produced no increase in the glycosuria. He also observed that the glycosuria disappeared before the albuminuria with the cessation of the administration of the poison. The further administration of uranium in large doses caused only profuse albuminuria dependent on the presence of parenchymatous nephritis. According to Lépine's observations the glycosuria produced by uranium may be very considerable. He has observed as much as 14 gm. of sugar in the urine two days after the injection of uranium nitrate, and this, notwithstanding that no food had been administered since the injection. The quantity of sugar present is not only far greater than the amount of albumin, but it may be greater than the amount of urea. Further, it can be shown that the glycosuria produced by uranium is accompanied by a definite hypoglycæmia. Lépine also considered that uranium in small doses increases the amount of the glycolytic ferment that he has described in the blood, and he thinks it is probable that the very slight beneficial action that uranium salts have produced in certain cases of diabetes may possibly be attributed to this action. Uranium salts, however, in slightly larger doses undoubtedly increase the permeability of the kidney for sugar, and thus cause marked glycosuria. Several observers, especially Jacobi and Richter, have shown that caffeine and diuretin may cause glycosuria in animals provided the diet contains abundant carbohydrates, and they look upon these diuretic substances as tending to

increase or even to produce some forms of alimentary glycosuria. This variety of glycosuria is also associated with hyperglycæmia.

It would seem from all these observations that our views as to the mode of production of glycosuria must be very considerably widened, and that a number of poisons are capable of producing the excretion of very considerable quantities of sugar by a renal action leading to an increased permeability of the kidney for sugar. A further point of interest is the fact that many of these substances cause in larger doses a parenchymatous nephritis, and that when this is established the excretion of sugar by the kidney ceases. This result is in harmony with what is not uncommonly seen in some forms of diabetes where Bright's disease occurs as a so-called complication, and where its onset is marked by a diminution or even a disappearance of the sugar in the urine. Many of these renal poisons causing glycosuria when administered in very small doses produce slight albuminuria. All these observations certainly tend to confirm the opinion that some forms of glycosuria and probably of diabetes are of renal origin.

Œdema and Hydrorrhœa in Chronic Nephritis. Œdema of the intercellular tissue is, of course, one of the cardinal effects of chronic renal disease, and in addition to the ordinary general dropsy, which is such a frequent accompaniment of chronic Bright's disease, localized but fugacious patches of œdema of sudden onset are not uncommon. They are frequently symmetrical, and are characterized among other points by their indolence and great pallor. Valentino¹ considers that these areas of œdema are dependent in part on osmosis and in part on filtration. Many French authors draw attention to the fact that the retention of urinary products in the blood stream must greatly modify the process of osmosis and lead to these constituents passing into the tissues, and inasmuch as the extractives and salts which ought to pass out through the kidneys are thus retained in the tissues this leads to the passage of water from the blood into the tissues. It is very probable that in addition to this mechanism there may be an increased filtration owing to alterations in the pressure relations of the blood in renal disease, and, further than this, it is very probable that the permeability of the wall of the bloodvessels is altered by either a structural change or else as a result of the variations in the vascular tone. In addition to these general factors the distribution of œdema will be determined in part by local factors, such as the relative abundance of bloodvessels and the degree of support afforded by the perivascular tissue. Thus, the eyelids, as is well known, are very commonly the seat of the œdema of Bright's disease. Valentino draws

¹ *Revue de médecine*, October, 1902.

attention to the fact that the mucous surfaces may also be affected in a similar manner owing to their considerable vascularity and the lax arrangement of the connective tissue. Thus, the pulmonary mucous membrane is liable to be affected owing to its richness in vessels, and the laryngeal mucous membrane owing to the abundant loose connective tissue. Œdema affecting the larynx and the lungs is well known as a serious and common complication of renal diseases, but these are by no means the only mucous membranes which are liable to be affected. The author mentions the frequency with which the tongue becomes œdematous. This is revealed by the impressions made in the margins by the teeth. Like the œdema of the eyelids, this œdema of the tongue is only seen in the morning. It disappears during the day on account of the movements of the tongue, just in the same way as the œdema of the eyelids may diminish or disappear owing to its movement. Under ordinary circumstances œdema of the mucous membranes is not an obvious physical sign even in renal disease, but under certain conditions an œdematous mucous membrane becomes the seat of a flux of serum. Among the best known may be mentioned the intestinal and gastric flows, which may produce very severe diarrhœa or copious vomiting. Under normal circumstances the intestine is mainly but not entirely an absorptive apparatus, but pathologically it readily becomes an organ of elimination, and this is more especially the case in renal disease. According to Valentino, abundant losses of serous fluid may occur not only from the stomach and intestine, but also from the uterus and the nose, and he draws a distinction between a hydrorrhœa and a hypersecretion, although it is difficult to distinguish between the two clinically.

Valentino quotes one case of chronic Bright's disease accompanied by uterine hydrorrhœa, and a second of chronic interstitial nephritis where a very considerable rhinorrhœa existed, and considerable quantities of clear fluid of a specific gravity of 1011 were obtained from the nose. It would seem advisable, in the light of these cases and of others quoted in his paper, to examine all patients presenting signs of excessive secretion from the eyes, nose, etc., for chronic and latent renal disease, but the frequency with which this lies at the root of the morbid process must be very slight, as by far the great majority of such cases are of local origin and due to morbid processes of a totally different character, whether in the nose or uterus, etc.

Albuminuria. Daremberg and Moriez¹ deal with the variations in the amount of albumin, of uric acid, and of the acidity of the urine in different forms of albuminuria. These authors mention especially

¹ *Revue de médecine*, September, 1902.

that in almost all forms of albuminuria, where there are daily variations in the amount of albumin, the minimum amount is found in the morning. In only two instances out of one hundred examinations was this not the case. The diminution in the amount of albumin in the morning is observed in a great variety of maladies—*e. g.*, in Bright's disease, gout, puerperal cases, and as a result of scarlatina and even in tuberculous lesions. In one case of hemorrhagic scarlatinal nephritis in a young girl a typical cyclic albuminuria developed during convalescence, the morning urine being free from albumin, the maximum amount being present at 2 P.M., and the urine being again free at 7 P.M. The time of occurrence of the maximum is somewhat uncertain, and may in different cases vary between 1 o'clock to 5 o'clock in the afternoon. The study of various forms of albuminuria seems to show that although in different cases there may be diurnal variations in the amount present, these variations are always variations in degree and not in kind. Thus, in some cases there is no albumin in the morning or in the evening; in others, where there is albumin throughout the twenty-four hours, there is less in the morning and evening. It is a point of considerable interest that a case of persistent albuminuria may become one of intermittent or cyclical albuminuria where the urine is free in the morning and evening, and, on the other hand, that a case beginning as one of cyclical albuminuria where the urine was free in the morning and evening may become one of permanent albuminuria with the minimum in the morning. These authors consider that an inconstant albuminuria, where the morning and evening urine is entirely free from albumin, may be the sequel or terminal stage of a former permanent albuminuria, or, on the other hand, the initial manifestation of an albuminuria that may subsequently become permanent. This is a point of great importance in diagnosis, as it would imply that the disappearance of the albumin from the morning urine is not to be taken necessarily as excluding the presence of organic disease; in other words, as distinguishing between a so-called physiological or functional albuminuria and that dependent on serious renal disease. The associated symptoms and physical signs are the only sure means of deciding whether an albuminuria is dependent on a transitory affection of the kidney or is an initial manifestation of a grave disease, or, lastly, a terminal manifestation of a former attack of grave renal disease.

The time of occurrence of the maximum elimination of albumin is not constant. In most of these authors' observations it occurred between 11 o'clock and 5 P.M., and they consider that in cases of permanent albuminuria with a morning minimum the maximum is seen between 1 o'clock and 5 o'clock. Where the albuminuria has been constant and completely absent in the morning the time of appearance

of the maximum may vary from 10 o'clock in the morning to 10 o'clock at night. Darenberg and Moriez consider that posture is not always the cause of the increased excretion of albumin. They obtained some curious results as regards the influence of diet. Where the albuminuria was permanent and the patients did not suffer very much from it, red meat and asparagus doubled the amount of albumin, and occasionally where the albuminuria was inconstant with a morning and evening minimum, a restricted diet led to a diminution of the albuminuria. In a large number of instances, however, diet had but little effect on the quantity of albumin secreted. Arsenic, in the form of arseniate of soda, not uncommonly led to a diminution of albuminuria, even when the diet was not restricted. On the other hand, iodide of potassium was found to increase the albuminuria in one case of permanent albuminuria. Massage was found to increase the albuminuria, as a rule, where this was persistent and permanent, and in some instances the albumin was doubled in amount. In the cases of cyclic or inconstant albuminuria massage was sometimes of benefit. Owing to the great variations, both spontaneous and as the result of treatment that occur in these cases of so-called cyclical albuminuria, these authors consider that this term should be replaced by that of inconstant albuminuria. In the cases of albuminuria where the albumin is absent in the morning the quantities of urine do not vary in relation with the total quantities of albumin. In the case of children the quantities of urine may vary from approximately 500 c.c. to 1000 c.c. (16 oz. to 32 oz.), and in adults from 800 c.c. to 1500 c.c. (26 oz. to 50 oz.). These authors also failed to observe any constant relationship between the quantities of phosphates excreted and the amounts of albumin. They had conducted a series of observations as to the relationship, if any, between the total acidity of the urine and the albuminuria, and in some instances an increase in acidity occurs at the same time as the increase in the amount of albumin. At first they considered that this was the case always, but more extended observations showed that the cases could be divided into two groups corresponding to two different clinical types. In those cases of albuminuria where the morning urine is free from albumin, and where this is greatly influenced by diet, the increase in the acidity and in the quantity of albumin occur together. On the other hand, in those forms of albuminuria not influenced by diet the maximum of acidity often corresponds in time to the minimum of albumin. These observations deal, however, with the total acidity of the urine in twenty-four hours. The curve illustrating the rate of excretion of the acid salts does not by any means run parallel to the albumin curve. In some instances the two may be parallel, but not uncommonly they are directed in opposite directions,

and the maximum of acidity may occur with a minimum of albumin. The authors are inclined to think that the acidity curves and the albumin curves are inclined to be parallel in the inconstant albuminurias which are becoming permanent, or in the inconstant albuminurias which occur as terminal phenomena in cases of former constant albuminuria. And, on the other hand, that in cases of slight albuminuria which have no tendency to become permanent the curve in the excretion of acid is in the opposite direction to that of the albumin. One of the most difficult points in clinical medicine is often to determine with certainty whether a given albuminuria is of the inconstant or cyclical type or of a more serious permanent type, and if these observations are extended and confirmed they might afford some light on this question. The quantity of uric acid excreted generally varies in the same direction as that of the amount of albumin; the greater the albuminuria, the greater the quantity of uric acid. Thus, in the cases of albuminuria influenced by diet and where the albumin is absent in the morning the uric acid acidity and albumin curves are all concordant, whereas in the albuminurias not influenced by diet the uric acid and albumin curves are in agreement, but the curve of acidity differs. The variations in the diet may profoundly affect the total acidity of the urine and the amount of uric acid excreted when they are without influence on the quantity of albumin. Thus, a fish diet may greatly diminish the total acidity without materially affecting the quantity of albumin. On the other hand, arseniate of soda, when given along with an ordinary diet, may diminish the acidity and halve the amount of albumin and uric acid excreted, and, for this reason, the authors state that in cases of albuminuria which are not influenced by diet arsenic is the most valuable remedy. The authors consider that in healthy individuals the quantity of uric acid excreted is proportional to the total acidity of the urine, and that this is dependent on the acidity of the urine, being due indirectly to the uric acid and the interaction taking place between the uric acid and neutral phosphate of soda, leading to the formation of acid phosphate of soda and biurate of soda. On the other hand, in cases of albuminuria where the albumin is absent in the morning the curve of excretion of uric acid is often inverse to that of the curve of acidity, so that a very acid urine may contain but little uric acid. They regard this as dependent on the excretion of a number of acids, such as hippuric, oxalic, sarcosactic. These acids are normally neutralized or destroyed in the organism, and the authors consider that in these cases of albuminuria there are disturbances of nutrition which do not occur in the healthy. The most important conclusions of the authors are to be summarized as follows: in cases of albuminuria where the outlook is favorable the

albumin is either not present in the morning or is then at a minimum, and the maximum excretion occurs at very variable times. In cases of permanent albuminuria the maximum always occurs between 12 and 5 o'clock. In many cases of inconstant albuminuria posture has nothing or little to do with the quantity excreted. Where the albuminuria is favorably influenced by diet, alkalies are frequently useful. Where diet has no influence, arsenic is the most valuable remedy. Massage is of very doubtful utility in both groups and may be harmful. The time of occurrence of the maximum excretion of acid and of uric acid are constant in the healthy, but very variable in cases of albuminuria. Finally, patients suffering from inconstant albuminuria may increase in weight even at a time when the quantity of albumin in the urine is increasing.

Indicanuria. Indican is present in the urine normally in small quantities, and it is well known that in disease the quantity may be increased to such an extent that if converted into indigo it may cause the urine to assume a deep-blue color. Indican is excreted in combination with sulphuric acid, and its presence in the urine and especially its amount have been correlated with the decompositions that occur in the intestine. Thus, the quantity in the urine is known to undergo great increase with many forms of intestinal obstruction, especially the more chronic varieties. This, however, is not the sole source of indican, as considerable quantities of it may be excreted in other morbid states—*e. g.*, empyema, gangrene of the lung. Carles¹ has observed the excretion of indican in a number of affections of the stomach with the object of determining whether the amount of indican present in the urine is capable of affording information as to the degree of activity of the gastric secretion. He considers that observations on the amount of indican in the urine will not only give more accurate information than the determination of the amount of chlorides or the amount of urea, but that the results are quite comparable to those obtained by the direct analysis of the gastric contents after a test-meal. Carles agrees with the current opinion that the source of indican is the indol formed in the course of pancreatic digestion owing to the action of certain organisms, but that this intestinal formation is greatly influenced by the degree of activity of the gastric digestion and especially by the amount of hydrochloric acid secreted. In order to estimate the amount of indican he uses the following simple process: equal parts of urine and hydrochloric acid are mixed in a test-tube; a small quantity of chloroform is added, slight heat applied, and a few drops of oxygenated water. The contents of the test-tube are then well shaken,

¹ *Revue de médecine*, April, 1903.

and the indican is dissolved by the chloroform and its quantity estimated by the depth of color of the fluid, which may be mauve, lilac, blue, violet, or indigo. The amount present is determined by a color standard, the chloroform solution being compared to other solutions containing a known quantity of pure indigo. The method is certainly a simple one if future observations should show that it is reliable. The first case examined was one of chronic gastritis associated with a hypersecretion of hydrochloric acid, as was shown by the results of a test-meal. The urine was examined systematically for two months, and, according to the author, there was a complete absence of indican. Similar results were obtained in four other cases where the chronic gastritis was accompanied with hypersecretion of hydrochloric acid. One case was of considerable interest, inasmuch as pyloric stenosis was present and the gastric contents had undergone decomposition notwithstanding the presence of considerable quantities of hydrochloric acid. The urine, however, only contained traces of indican. The author considers that the excessive secretion of hydrochloric acid may influence the formation of indigo in two ways: that in the first place it may lead to an imperfect pancreatic digestion, or, secondly, that it may directly interfere with the activity of the microbes that normally lead to the formation of this substance. In seven cases of various forms of gastritis and of dilatation of the stomach associated with a diminished secretion of hydrochloric acid, indican in variable quantity was found in the urine, and in one case the dilatation of the stomach was associated with a movable kidney. In some of these cases, when the gastric symptoms were relieved by a milk diet, the indicanuria disappeared. In malignant disease of the stomach associated with great diminution of hydrochloric acid, large quantities of indican were found in the urine. In some cases of carcinoma ventriculi the hydrochloric acid is not notably diminished, and in these cases, according to the author, indicanuria is not marked. In febrile diseases indicanuria is often well marked, and the author thinks this is to be correlated with the deficient gastric secretion that occurs under such conditions. Carles concludes that indicanuria is absent in cases of hypersecretion of hydrochloric acid, and that, on the other hand, it is always present as a result of diminished secretion of this acid, and that very large quantities of indican are contained in the urine where the secretion of hydrochloric acid is arrested.

Surgical Treatment of Chronic Nephritis.¹ The first attempts at the surgical treatment of nephritis were made by Reginald Harrison in 1896, in a paper published in the *Lancet*, entitled "A Contribution

¹ PROGRESSIVE MEDICINE, June, 1903, p. 123.

to the Study of Some Forms of Albuminuria Associated with Kidney Tension and their Treatment." Harrison, in the course of his surgical experience, had been struck by the variability in the size and consistence of the kidney when exposed in the course of surgical procedures, and also with the fact that relief from pain and other renal symptoms was not uncommonly obtained as a result of an exploratory nephrotomy where no organic disease involving gross changes in the kidney had been detected at the time of the operation. Cases simulating renal calculus in their symptoms and causing pain and hæmaturia are not uncommonly relieved by exploratory operation where no stone or other gross lesion is detected. He was led from the consideration of such cases to regard the symptoms as possibly due to increased renal tension, and the beneficial result after the operation to be associated with the relief afforded by the incision of the capsule and the drainage of the kidney produced by the incision into the renal pelvis. Harrison in this paper detailed three cases of a somewhat different character, which may be said to have laid the foundation of the operative treatment of nephritis. In 1878 an exploratory nephrotomy was performed by him on a young man, aged eighteen years, who was suffering from intense lumbar pain associated with albuminuria and the presence of casts, the onset of the renal symptoms having occurred some three weeks after an illness that was in all probability scarlet fever. The operation was undertaken under the impression that there was suppuration in the vicinity of the kidney. The kidney was found to be very tense, but no pus was present, and a free incision was made into the tense organ. Blood and urine were discharged from the wound for some days, but the wound rapidly healed, the excretion of urine became more abundant, and the albuminuria completely disappeared. This was in all probability a case of scarlatinal nephritis. In the second case, operated on in 1887, the patient suffered from hæmaturia associated with colicky pains in the groin suggesting the presence of renal calculus. Some months later the urine became highly albuminous, and a nephrotomy was performed on the right kidney. No stone was found, but the kidney was extremely tense. A drainage-tube was inserted, and in the course of a short time the wound healed, the urine became quite normal, and the patient completely regained his health. The third case, operated on in 1893, was that of a lady, aged forty-four years, who suffered from slight hæmaturia and occasional albuminuria. After an attack of influenza the albumin increased in amount and was constant. The patient was supposed to have passed a small calculus some months previously, and owing to the presence of pain over the left kidney this was explored, but on incision no calculus could be discovered. As a sequel to the operation the urine became quite

normal, and the patient remained well three years after the operation. Harrison looked upon the first case as one of scarlatinal nephritis, and the other two as nephritis due in the one case to cold and damp and in the other to influenza. These cases are very remarkable, and especially from the fact that a unilateral operation was at any rate followed by the complete subsidence of symptoms in an affection—nephritis—which is usually looked upon as invariably bilateral.

Other surgeons in the course of the next few years performed similar operations, and rapidly extended both their nature and their scope. This was particularly the case with Edebohls,¹ who, in 1898, performed an operation with a view of bringing about a cure in a case of chronic Bright's disease. His results are considered by William B. Coley in *PROGRESSIVE MEDICINE* for June, 1903, p. 123, and also by William T. Belfield in the present volume.

Pousson² has also had some experience of this operation in the case of acute toxic nephritis, and also in certain cases of subacute chronic nephritis; in other words, of Bright's disease. Pousson has operated four times on cases of acute infective nephritis occurring sometimes as complications of general diseases and in other instances as a result of ascending infection of primary vesical diseases. The first case was one of suppurative pyelonephritis of the right kidney, which was of acute origin and unaccompanied by any other malady. The right kidney was exposed; it was enlarged and tense, and at its upper extremity was a grayish mass of softer consistence than the rest of the organ. This was incised, and a puriform fluid escaped. The incision of the renal substance only caused a free escape of blood, and the pelvis of the kidney contained no pus. The patient had a slow recovery, but ultimately regained her former good health, and the urine became normal. The second case was one of suppurative nephritis, where the kidney was found at the operation to contain not only one abscess of appreciable size, but also large numbers of miliary abscesses. These abscesses, however, were confined to the upper half of the kidney, the organ was incised, and as many of them evacuated as possible. The patient, who was in an alarming condition on his admission, improved notably, although the albumin did not entirely disappear from the urine. The third and fourth cases were both cases of nephrectomy for pyelonephritis, and need not be considered here. Pousson in his paper quotes a number of instances collected from literature where nephrotomy has been successful in the treatment of acute suppurative infections of the kidney, even when numerous miliary abscesses have been found to be

¹ *Medical Record*, March, 1903.

² *Annales des maladies des organes génito-urinaires*, May, 1902.

present. Pousson records in his paper twenty-three instances of acute infective or suppurative nephritis where operative interference has been successful in eighteen cases. In some cases the affection of the kidney was of acute onset and dependent on the blood infection. In other instances the infection reached the kidney through the ureter as a sequel to primary vesical disease. Pousson considers the objections that have been raised against operative interference in such cases. In a number of instances the prognosis of these acute renal infections is good, but this only applies to a certain proportion of the cases of what may be called primary renal infection, and does not apply to the instances where the renal disease is a sequel or accompaniment of vesical mischief. Pousson considers that operative interference should be limited to the severe cases where there is considerable fever and the general condition of the patient reveals the grave nature of the lesion, and, further, where such a complication as anuria exists. A second objection has been raised and rests on the fact of the assumed bilaterality of suppurative and infective nephritis. Pousson quotes Goodhart as stating that in 130 cases of suppurative nephritis observed in the post-mortem room in nineteen cases only one kidney was affected, giving a proportion of 14.5 per cent. It is very probable that these toxic and infective forms of nephritis are more commonly unilateral in their onset than is usually thought. A third objection that has been raised is the difficulty of determining which kidney is affected when the lesion is unilateral. Pousson considers that renal tenderness will often enable the diagnosis to be made or that the cystoscope may show from which ureter the turbid and purulent urine is issuing. Catheterization of the ureter would doubtless be a certain means of answering the question, but is not to be recommended owing to the risk of infecting the healthy kidney. Pousson considers that the nephrotomy acts beneficially, even where the renal abscesses are very numerous, by draining the organ and by the great relief afforded to the tension and congestion. Further, he thinks it is very necessary in these cases to drain the renal pelvis and calyces.

Pousson records the effect of similar observations in some cases of peculiar forms of chronic nephritis. His results are of considerable value owing to the very full details of the cases published, and it is impossible to arrive at a conclusion as to the value of nephrotomy without ample details being given of the condition of the patient prior to operation. The first case was one of albuminuria and hæmaturia accompanied by cedema, which was apparently mainly confined to one side of the body and especially to the arm. The general health was considerably impaired owing to the presence of marked wasting, and prior to the operation the patient suffered from headache, dyspnœa, and

drowsiness; in other words, uræmic symptoms were present. The quantity of urine excreted fell to 750 gm. (24 oz.), and contained only from 4 gm. to 6 gm. (60 gr. to 90 gr.) of urea. About nine months before the onset of these severe symptoms hysterectomy had been performed to remove a fibroid that was causing vesical symptoms, such as difficulty of micturition and retention. All these vesical symptoms disappeared after the hysterectomy, and the patient remained in good health for some three months, when the œdema and the wasting supervened and soon afterward the hæmaturia and albuminuria. Pousson performed nephrotomy on the left side owing to the presence of some renal tenderness on that side. The patient was relieved by the operation, which consisted of a free incision into the kidney, together with drainage of the renal pelvis for some days. But some six months later the uræmic symptoms returned and a left-sided nephrectomy was performed. When the patient left the hospital a month afterward the quantity of urine was normal, free from blood and casts, and contained from 15 gm. to 20 gm. (225 gr. to 300 gr.) of urea and only traces of albumin. Microscopic examination of a fragment removed at the first operation and also that of the kidney removed at the second showed the presence of very advanced lesions. The glomeruli showed thickening of the capsule of Bowman, and in many places these consisted simply of masses of fibrous tissue. The epithelium of the convoluted tubules was in some places normal, but in others had undergone fatty degeneration. Over extensive areas of the kidney the epithelium had lost its characters and had become clear and hyaline. There was a notable increase of connective tissue between the tubules, and the arteries showed well-marked lesions of periarteritis and endarteritis. This case is quoted at some length owing to the importance of the results observed. Pousson considers that the lesion was unilateral chronic nephritis probably dependent on pressure of the fibroid on the ureter, and he considers that unilateral disease is capable of producing general symptoms such as were present in this case by an obscure reflex effect of one kidney on the other. It is a very remarkable fact, as the right kidney was either healthy or at any rate not profoundly diseased, as shown by the ultimate result that at any rate for a time this right kidney was not performing its functions adequately, as shown by the onset of uræmic symptoms and the very notable diminution in the quantity of urine excreted. There is some evidence to show that unilateral disease, like calculus, may occasionally produce bilateral symptoms; but if Pousson's explanation is correct, that a unilateral consecutive nephritis is capable of affecting the functions of the opposite kidney reflexly, a fact of considerable importance to clinical medicine will have been discovered. Another remarkable phenomenon was the

subsidence of the symptoms after the nephrotomy. The quantity of urine increased and the uræmic symptoms disappeared, and this was the case as long as the left kidney was being drained. After the removal of the left kidney the quantity of urine rapidly increased and the urea excretion became normal, and this Pousson regards as a further illustration of the reflex effect of one kidney on the other. Pousson records a somewhat similar case where the chronic nephritis was also probably unilateral and dependent on calculi. Here, also, the presence of uræmic symptoms was relieved by nephrectomy, but there was some return of the symptoms when the wound was closed and the drainage of the kidney ceased. Pousson considers that in many of these cases nephrectomy might perhaps be a better procedure than nephrotomy. Pousson records some other cases of interest, and especially one in a man, aged thirty-four years, suffering from chronic diffuse nephritis with very general œdema and some uræmic symptoms. Some 700 c.c. (22 oz.) of urine of a specific gravity of 1018 and containing 13 gm. (195 gr.) of urea and 3.8 gm. (67 gr.) of albumin per litre (2 pints) were excreted in the twenty-four hours. A nephrotomy was performed on the right side, and two days after the operation the quantity of urine had increased to 1200 c.c. (38 oz.), and there were 14 gm. (210 gr.) of urea in the twenty-four hours' urine. The œdema also began to diminish, and Pousson draws attention to the fact that it disappears first of all on the right side. The improvement produced by the operation was maintained, and six months after the operation there had been no return of the œdema or of the uræmia, but the urine still contained $2\frac{1}{2}$ gm. (37 gr.) of albumin and a few casts. Nephrotomy was also performed in another case of a man, aged forty years, suffering from interstitial nephritis (granular kidney) with double hydrothorax and hydropericardium, together with some signs of general anasarca. Under medical treatment the urine, which contained a trace of albumin, underwent a diminution and the patient got steadily worse. Nephrotomy was performed, and four days later the secretion of urine was greatly increased in quantity and the patient improved considerably, and seven months after the operation the only sign of disease is that the urine still contains a trace of albumin. A consideration of all the foregoing cases would lead to the conclusion that at present operative interference in the form either of nephrotomy or of decapsulation has been proposed and carried out in the following conditions:

1. For the relief of extreme congestion or extreme tension of the kidney (Harrison).

2. Nephrotomy has been performed for unilateral infective and suppurative nephritis, and has been successful even when the kidney contained a number of scattered and even miliary abscesses.

3. Nephrotomy has been performed successfully for the relief of urgent symptoms—*e. g.*, uræmia, in certain peculiar cases of chronic consecutive nephritis (Pousson).

4. Nephrotomy (unilateral) has been performed in certain cases of chronic Bright's disease and granular kidney, and it is claimed that great relief has ensued, although the operation was only unilateral, and the patients cannot be regarded as cured, as the urine remained albuminous (Pousson).

5. Bilateral decapsulation has been claimed by Edebohls as a successful procedure in a number of renal diseases, including chronic Bright's disease, provided that the operation in these cases is performed sufficiently early.

It is perhaps too soon to express a positive opinion on the value of these variable procedures, but it would certainly seem that nephrotomy and drainage are of very considerable value in the treatment of septic affections of the kidney when unilateral, and Pousson's results would seem to imply that the operation may also be of value in more chronic affections of the kidney, although it must be admitted that in the present state of our knowledge it is very difficult to understand why uræmic symptoms should be present in patients where one kidney is healthy.

Renal Calculus. Serguiewsky¹ has conducted an elaborate statistical inquiry with reference to the geographical distribution of renal calculus, and he draws attention to the very different methods the different writers have employed. The incidence of lithiasis in a district or country has been determined usually by one of the following methods:

1. Collection of the number of deaths due to lithiasis in relation to the total deaths.
2. An attempt to determine the actual number of cases of lithiasis.
3. The number of cases admitted into hospitals.
4. Observations based on the impressions of practitioners as to the frequency of the occurrence of the malady.

It is obvious that these methods are open to very great sources of fallacy, and this is the probable explanation of the very contradictory results that have been obtained formerly. Serguiewsky considers that when allowance has been made for these fallacies calculous disease is common in the following countries: Iceland; certain parts of Great Britain, more especially North Wales, Westmoreland, Norfolk, etc.; France, Holland (but not so frequent as formerly), Bavaria, northeast and east of Bohemia; in Italy, especially Lombardy and Naples; Bosnia, the watershed of the Volga in Russia; European Turkey, especially Macedonia; in Asia Minor, especially Smyrna, Arabia, and the regions of

¹ *Annales des maladies des organes génito-urinaires*, June, 1902.

Persia in the vicinity of the Caspian ; the northern and some of the central provinces of India, and in China, Canton, and the province of Taku ; in Africa, lower Egypt, and Abyssinia, and the Islands of Mauritius and Madagascar. In America it would seem that certain States are especially affected, such as Tennessee, Kentucky, Ohio, Indiana, Pennsylvania, and Virginia. On the other hand, calculous disease is rare in Norway, Sweden, and Denmark ; in certain counties of England (like Middlesex and Cheshire), the central and northern portions of Germany, in Finland, northern and western Russia, Central Africa, and Central America, Peru, the Argentine, and the Antilles.

It will be seen from this short summary that lithiasis is to be found all over the surface of the globe, but at the same time the distribution of the disease is extremely unequal and many explanations have been suggested to account for this. Climate has been supposed to act both directly and indirectly ; thus, in humid, temperate climates the function of the skin is far less active than in tropical climates, and it has been supposed that in this way the composition of the urine might be modified in such a manner as to predispose to the formation of stones. Many writers have, however, supposed that the influence of climate is purely indirect, and that its effects are due really to the wealth or poverty of the soil and the resulting abundance or want of food. The great objection to accepting the belief that climate is a potent cause of lithiasis is such a fact that in Holland, where lithiasis used to be frequent, it is now rare, notwithstanding the absence of any climatic change. Lithiasis has, of course, also been associated with hard water or water containing considerable quantities of calcareous salts, but here, also, the malady cannot be directly correlated with the quality of the water. Thus, there are many districts in Switzerland where the water is highly charged with calcareous salts and yet lithiasis is very rare. Some writers have thought that the presence of chloride of sodium in water was a preventive to the formation of calculi. Chloride of sodium increases the solubility of uric acid, and it also necessarily leads to the drinking of larger quantities of fluid. Serguiewsky considers that, although it is possible that certain waters may have a prophylactic action in preventing the formation of stones, the injurious action of other waters is not proved. It would also seem that the malady cannot be correlated with any particular diet ; a highly nitrogeous diet is looked upon by some as a cause, especially in England. In other countries, as is well known, lithiasis is abundant notwithstanding a vegetarian diet, and, strange as it may seem, a diet which in one part of the world is looked upon as a cause of lithiasis in another part is regarded as a preventive. Thus, it appears that diet alone cannot explain either

the formation or the geographical distribution of lithiasis. It would seem that in most countries the children of the poor are much more liable to lithiasis than those of the well-to-do. In the lithiasis that occurs in every patient the formation of stones is perhaps especially associated with catarrhal inflammations of the urinary passages. It would seem that the study of the geographical distribution of the disease, even on the extensive scale that this author has carried out, does not throw any real light on the etiology of lithiasis. His most important conclusions are that lithiasis is very unequally distributed in the world, and that there would seem to be endemic foci in certain countries. There is no theory available that will account satisfactorily for the distribution of the disease, and it is only in Egypt that the real cause of the local prevalence of the disease, namely, the presence of *bilharzia*, is known. Social conditions play a very great part in the distribution of lithiasis in children, and it is possible that there may be some racial influence.

Nocturnal Secretion of Urine (Nycturia). Péhu¹ deals in a paper on the quantity of urine excreted and more especially with reference to the relationship between the quantity excreted by day and by night. Under normal circumstances the hourly daily excretion is twice as abundant as the nocturnal hourly secretion. In a number of pathological conditions the nocturnal elimination is more abundant, and for this condition Péhu proposes the name of *nycturia*. Many clinicians have noted that this condition that Péhu calls nycturia occurs in a number of maladies. Thus, Quincke had shown that in a number of cardiac diseases the nocturnal urinary excretion might greatly exceed the diurnal just as Bartels had shown the same fact in granular kidney. This condition of nycturia was found by Iljisch in all cases of heart disease where anasarca was present, but in addition to this also in those where compensation failed. Many writers have supposed that nycturia was a condition limited to cases of prostatic, vesical, and renal disease, but this is not really the case, and greater or less degrees of the affection may be present in a large number of diseases besides those directly implicating the urinary apparatus. Thus, it may occur not only in heart disease, but also in some hepatic affections and especially, perhaps, in diabetes. Further, it has been found in some so-called functional disorders, such as cyclical or physiological albuminuria. Péhu has carried out his observations on three great groups of cases, the first consisting of disorders of the systemic circulation seen in affections of the heart, kidneys, and the nervous system; second, in maladies affecting the pulmonary circulation; third, in affections of

¹ La Nycturie, Revue de médecine, May, 1903.

the portal system. Péhu considers that normally the hourly excretion of urine by day and by night bears the proportion of 2 to 1, but that it may within the limits of health be as 10 to 9. Any further increase in the nocturnal rate is to be looked upon as pathological. The diurnal urine is also less dense than the nocturnal. Péhu finds from the study of a very considerable number of cases that this condition of nycturia to a greater or less extent is present in a very large number of diseases. Among the first group of cases valvular diseases of the heart, myocarditis, renal disease, cardiac failure, and Addison's disease are all instances where nycturia may occur. This is also the case in emphysema and asthma and chronic tuberculous diseases of the lungs, and also in cases of hepatic cirrhosis and tuberculous peritonitis. Péhu made a large number of observations to try and ascertain the mode of production of nycturia. He found that the condition was not dependent on diet and could not be correlated with variations as regards the composition of the urine. Nor could it be associated even with variations in the density of the blood, but he thinks that it is to be associated with variations in the arterial pressure. Under normal circumstances arterial pressure falls notably during the night, whereas, according to Péhu, in pathological conditions the blood pressure at night does not fall. Péhu considers that the action of certain drugs is confirmatory of the influence of the arterial pressure on the production of nycturia. Diuretics, like theobromine and caffeine, may increase the amount of urine excreted, but these drugs do not cause the diurnal and nocturnal quantities to return to their normal proportions. On the other hand, digitalis does. Péhu draws attention to the necessity of distinguishing between nycturia and a mere diurnal polyuria dependent on the absorption of large quantities of drink, and he considers that nycturia is a symptom of considerable value pointing to the conclusion that the myocardium is not equal to its work.

PHYSIOLOGY.

BY ALBERT P. BRUBAKER, M.D.

METABOLISM.

On the Growth of Suckling Pigs Fed on a Diet of Skimmed Cows' Milk. About ten years ago Lusk and Sanford reared three newborn pigs of the same litter on centrifugalized skimmed cows' milk. To the milk of one pig 2 per cent. of milk-sugar was added; to that of a second, 2 per cent. of dextrose, while a third pig received skimmed milk alone. The experiments proved that the pigs could thrive on a skim-milk diet, and that the addition of sugars was advantageous. The milk was analyzed. The growth of the pigs in proteid substance was determined by analyzing a newborn pig of the same litter which was killed at birth. The percentage proteid composition was taken to represent that of the living pigs at the start of the feeding. Any gain of proteid noticed in the analysis of the pigs after the fourteen days of feeding could be attributed to growth.

Margaret B. Wilson¹ practically confirms these results. She found that skimmed cows' milk, with or without 2 to 3 per cent. of added lactose or dextrose, is normally absorbed by suckling pigs.

Two pigs fed on skim milk from fourteen to sixteen days gained 26.4 and 66.8 per cent. in weight. Two pigs fed on the same skim milk, with 2 and 3 per cent. of lactose added, gained 79.7 and 64.4 per cent. in weight.

Those fed with plain skim milk gained 114 gm. and 218 gm. in weight for every 1000 physiologically available calories in the food. The lactose pigs gained 222 gm. and 215 gm. per 1000 calories in the food. The dextrose pigs both gained 213 gm. per 1000 calories in the food. Except in the case of one ill-nourished skim-milk pig, the growths of the sucklings stand in a constant ratio to the calories in the food.

The pigs fed on plain skim milk used 23 to 25 per cent. of the proteid in the food for tissue growth; the lactose pigs used 38 and 44 per cent., and the dextrose pigs 48 and 42 per cent.

¹ American Journal of Physiology, 1902, viii., 3, p. 197.

All the pigs of the second litter gained in fat when fed on plain skim milk or on skim milk with sugars.

The percentage of calcium in the bodies of the pigs diminished with their growth. There was considerable and normal deposition of calcium in the pig, and this was proportional, not to the calcium in the food, but to the growth of the animal.

Not only is the growth in grammes of the pigs proportional to the calories in the food, but the number of calories retained in the tissue substance during growth is proportional to the calories in the food; 18 to 19 per cent. of the calories in the food were found stored in the tissue growth of the pigs fed on the three varieties of skimmed milk.

There seems to be striking evidence that the suckling pig reared on skimmed cows' milk conforms to the same laws of nutrition as the breast-fed infant.

Further Observations on the Sequence of Changes Produced in the Urine as a Result of Exercise. Garratt¹ claims that an early excretion of sulphuric acid appears to be a constant feature in the metabolism which accompanies rapid muscular exercise. The acid seems to pass out in combination with potassium and ammonium, and the maximum output occurs several hours before that of total nitrogen.

The increased excretion of phosphoric acid resulting from exercise bears close relation to that of free acid and urea. The acid appears to be eliminated chiefly in combination with the alkaline earths and ammonium.

The normal relation between sodium and chlorine does not seem to be conspicuously disturbed by exercise, nor is the usual influence of increase in the urinary water upon them prevented thereby.

A Physiological Study of Nucleic Acid. The successive changes of opinion regarding the origin and elimination of uric acid in the animal body form an interesting chapter in the history of physiological research. The abandonment of the earlier theory which connected the formation of uric acid directly with the decomposition products of the proteids was due to the failure of experimental proofs. In its place has arisen a series of hypotheses which have stimulated investigators to undertake new lines of research, and have given direction to the modern teaching regarding the metabolism of the so-called "nucleins."

Though it has been experimentally proven that leucocytic decomposition causes a formation of uric acid (Horbaczewski's view), this can no longer be regarded as the only method of formation. The investigations of recent years indicate clearly that the purin (or alloxuric)

¹ Journal of Physiology, 1903, xxix., 1, p. 13.

compounds of the urine owe their origin almost entirely to antecedent purin groups introduced into the body as food or otherwise.

Mendle, Underhill, and White¹ have added further experimental evidence. The more important observations which they record indicate that the vegetable nucleic acid obtained from the wheat embryo (with which their experiments were done) resembles in its physiological effects the guanylic acid of the pancreas. Introduced in sufficient doses into the circulation, it may produce a fall in arterial pressure, a change in the coagulability of the blood, an increase in the flow of lymph, and a change in its composition, and, perhaps, also, a degree of immunity toward subsequent injections.

The ingestion of nucleic acid is followed in man by an increased output of uric acid, and in the dog by the excretion of allantoin. These products correspond in either case to only a portion of the purin radicles introduced. In animals allantoin excretion was also observed after the introduction of vegetable nucleic acids into the body per rectum, intravenously, intraperitoneally, and subcutaneously.

The Influence of Alcohol upon the Albumin Metabolism. Rudolph Rosemann² reviews the whole literature on this subject critically, and believes that all the modern experimenters are in satisfactory harmony. The result is: even the energy of a decidedly poisonous body may be utilized by the organism for its purposes. Alcohol, therefore, may be transformed by the organism in the same way as the carbohydrates and fats; but under certain conditions of which, perhaps, we only know a part clearly, alcohol regularly shows an albumin-destroying property, which may more or less counteract the albumin-saving power. This takes place if the individual is not accustomed to alcohol, but sometimes, even in those who are accustomed to it, during the first doses, and, finally, most probably with a small caloric value of the food. At any rate, this unfavorable effect of alcohol upon the albumin metabolism in the majority of cases seems to be only transitory, after which time the albumin-saving effect is shown clearly. This has been shown beyond any doubt by all experimenters who extended their experiments over such a length of time that the deleterious effect upon the albumin metabolism had disappeared.

Influence of the Velocity, the Body Temperature, and Exercise on the Metabolism during Rest and Muscular Work. From his experimental work on men, dogs, and horses, N. Zuntz³ recapitulates as follows: 1. The velocity does not perceptibly influence the amount of the metabolism for the same length of the road in the dog. It does

¹ American Journal of Physiology, 1902, viii., 5.

² Archiv f. d. ges. Physiologie, Band xciv. S. 589.

³ Ibid., Band xcv. S. 192.

so, however, in man and horse. 2. During elevated body temperature the metabolism of the resting body and that for the respiratory work is increased. The muscles, however, perform certain work with the same metabolism as during normal temperature. 3. The amount of consumed energy for the special performances of the musculature is considerably reduced by the practice; the practice for a certain work, however, does not cause any saving in other work for which the muscles have not been practised; with the greater practice of the musculature there occurs an increase in the metabolism during rest, the same as happens with an excess of albuminous food.

About the Respiratory Metabolism during Static Work. Arthur Bornstein and Ernest Poher¹ performed the experiments on each other. The static work done by them consisted in holding a weight in the hand of the stretched-out arm, which was raised to the side to the height of the shoulder while the person was lying down. The weight was held up for ten, twenty, or thirty seconds, with intervals of rest. The experimenters came to the following result: 1. The metabolism during static work does not increase proportionally with the sustained weight, but quicker. 2. The metabolism during static work does not increase proportionally with the duration of the working periods, but more so.

Results of Two Balloon Ascensions Made for Physiological Purposes. Hermann v. Schroetter and N. Zuntz² made two ascensions in May and June, 1902, and made careful observations with the following result: The morphological structure of the blood does not change up to a stay of ten hours at heights up to 5000 metres. Pulse and blood pressure remain unchanged unless a transitory want of oxygen makes itself felt also subjectively. The reducing power of the tissues, as determined by the time which must elapse from the moment of cutting off the blood supply to a certain body—part up to the point where one band of the hæmoglobin spectrum disappears, did not undergo any change. The ventilation of the lungs is increased, not essentially in consequence of the decreasing atmospheric pressure, but by the influence of the remaining meteorological factors. The qualitative change in the processes of oxidation which shows itself in a greater respiratory quotient commences at a height of about 4000 metres; the exact height varies according to the individual and the time. The subjective feelings caused by the want of oxygen do not always go parallel with the objective expression of it in the respiratory quotient. The small increase in the consumption of oxygen, observed in some experiments, may be sufficiently explained by the increased respiratory

¹ Archiv f. d. ges. Physiologie, Band xc. S. 146.

² Ibid., Band xci. S. 479.

work or by the action of other muscles, as in trembling and uncomfortable sitting.

Alcohol as Protection Against Poisonous Albuminous Bodies.

Dr. Walter Clemm¹ calls attention again to the fact that in recent cases of *snake-bites* alcohol in very large doses is the remedy par excellence. He believes that the explanation will be found along four lines: 1. In the greatly disturbed system of the bitten person, so much alcohol may be absorbed that the poisonous globulins are precipitated and made innocuous. 2. The alcohol may thus influence the nervous centres so that they are not attacked any more by the poison. 3. Even if the amount of alcohol in the body should not be enough to precipitate the poisonous globulins, it is very plausible that the molecular construction of the toxic bodies may thus be changed by the diluted alcohol so that their poisonous effect becomes lost. 4. Perhaps even before its absorption the alcohol may draw so much water into the stomach that the thickened poisoned blood may now exert a stronger effect upon the toxalbumins in the direction of 1 to 3.

Researches about the Respiratory Metabolism. In the first article J. Rosenthal,² the author, shows that the O_2 reception may be changed during respiration if the inspired air is made richer or poorer in this gas. There exists, however, no constant ratio between the O_2 reception and the O_2 amount of the inspired air, for the O_2 reception first of all depends upon the variations in the composition of the inspired air in such a manner that an animal which for a time was breathing air rich in O_2 , now takes in much less O_2 , as soon as it breathes air purer in O_2 . The same animal, however, after having inspired the air poor in O_2 for a time takes in much more O_2 , as soon as it is placed in air richer in oxygen.

Regarding the question what is done with this increased O_2 , the author from his experimental work comes to the following conclusions: Living protoplasm possesses the power to chemically bind the oxygen in a form the development of which is connected with little heat, and later to give off this oxygen again for the formation of CO_2 , H_2O and nitrogenous products similar to urea. The amount of this "intracellular oxygen" is variable. During high partial pressure of the O_2 , much more of it can be held than is necessary for the formation of the end products of the metabolism. During insufficient O_2 reception the formation of the end products can take place at the expense of the accumulated intracellular oxygen as long as the stored-up amount allows it.

¹ Archiv f. d. ges. Physiologie, Band xciii. S. 295.

² Archiv f. Physiologie, Supplementary Band, 1902, S. 278.

In the higher animals the hæmoglobin serves as the carrier between the oxygen of the surroundings and the O_2 binding particles of the protoplasm.

DIGESTION.

Since the promulgation of Ehrlich's theory in regard to the specific receptors of cells, everything pertaining to secretion and excretion, as well as the cellular assimilation of material, has taken on a new interest. The action of enzymes, chemotaxis, hæmolysis, and of metabolism have acquired an importance commensurate only with the revolutionary character of Ehrlich's work and the numerous recent studies on immunity. The majority of these studies will be reviewed under the heads of pathology and bacteriology, yet investigations in physiology that may eventually have bearing on the subject attract our attention.

The Mechanism of Pancreatic Secretion. It has long been known that the activity of the pancreas is normally called into play by the entrance of food into the duodenum. From previous experiments it was thought that this excitation was nervous in character, and that the reflex centres were situated in the ganglia of the solar plexus. Bayliss and Starling,¹ however, show that the mechanism is actually very different. They contend that the contact of the acid chyme with the epithelial cells of the duodenum causes in them the production of a body (*secretin*), which is absorbed from the cells by the blood current, and is carried to the pancreas, where it acts as a specific stimulus to the pancreatic cells, exciting a secretion of pancreatic juice proportioned to the amount of secretin present.

This substance, secretin, is produced probably by a process of hydrolysis from a precursor present in the cells, which is insoluble in water and alkalies, and is not destroyed by boiling alcohol. Secretin is not a ferment. It withstands boiling in acid, neutral or alkaline solutions, but is easily destroyed by active pancreatic juice or by oxidizing agents. It is not precipitated from its watery solution by tannic acid or alcohol and ether. It is destroyed by most metallic salts. It is slightly diffusible through parchment paper.

The pancreatic juice obtained by secretin injection has no action on proteids until "enterokinase" is added. It acts on starch, and to some extent on fats, the action on fats being increased by the addition of succus entericus. It is, in fact, normal pancreatic juice.

Secretin rapidly disappears from the tissues, but cannot be detected in any of the secretions. It is apparently not absorbed from the lumen of the intestine.

¹ Journal of Physiology, 1902, xxxviii., 5, p. 325.

It is not possible to obtain a body resembling secretin from any tissues of the body other than the mucous membrane of the duodenum and jejunum.

Secretin solutions, free from bile-salts, cause some increase in the secretion of bile. They have no action on any other glands. Acid extracts of the mucous membrane normally contain a body which causes a fall of blood pressure. This body is not secretin, and the latter may be prepared free from the depressor substance by acting on desquamated epithelial cells with acid.

In a later paper¹ the same writers give the results of their investigation into the uniformity of the pancreatic mechanism in vertebrata. They claim that the pancreatic secretin is not specific for each type of animal, but is a simple substance of definite chemical constitution common to all types of vertebrate animals. On the other hand, in spite of certain assertions to the contrary, there is no doubt that it is specific in its origin and in its action. Apart from the increase of bile which follows the injection of solutions of pure secretin, and may be direct or indirect, the direct action of secretin is limited to the pancreas. Of course, if a depressor effect is produced at the same time we shall get the usual effects of anæmia of the medullary centres, among which salivation may be mentioned. This secretion of saliva is not observed, however, if the nerves to the glands be previously divided.

Secretin is obtained by extracting the mucous membrane of the upper part of the small intestine with acid. From no other part of the body can secretin be obtained by a similar or any mode of procedure. They tried in this way mucous membrane of all other parts of the alimentary canal, the salivary glands, the liver, spleen, pancreas, kidneys, and tongue. They, therefore, conclude that pro-secretin exists only in that situation where it is in a position to be acted upon by the acid chyme and to discharge into the blood the body which shall act as the timely stimulus of the pancreatic cells.

The Precipitability of Pancreatic Ferments by Alcohol. Somewhat more theoretical in nature, yet interesting on account of its general relation to the same subject, namely, Ehrlich's side-chain theory, is the paper by Vernon² on the precipitability of pancreatic ferments by alcohol. From his results he argues that the tryptic and rennic ferments do not exist as independent chemical entities. On the contrary, they form a single complex molecular group of which various side-chains possess various powers, as of digesting proteids or of coagulating milk, which can be independently exerted. Moreover, these side-chains

¹ *Journal of Physiology*, 1903, **xxix.**, 2, p. 174.

² *Ibid.*, 1903, **xxix.**, 3, p. 333.

possess various degrees of stability, and it is possible for them to be destroyed separately, one at a time, without the activity of the remaining side-chains being in any way affected.

The Absorption of Iron in the Intestine. Rudolf Hoeber¹ has found that the substances soluble in the lipid plasma-covering of the intestinal cells (which he calls lipid soluble) are resorbed intra-epithelially, while the lipid insoluble ones are resorbed interepithelially. The salts of iron, however, seem to be an exception, as, though they are lipid insoluble, they are resorbed through the cells. This is the more remarkable as other heavy metals, though they behave similarly to iron as regards albumin and its derivatives, cannot thus be demonstrated in the intestinal epithelial cells. Although, therefore, salts of silver, mercury, bismuth, copper, nickel, or manganese can only be resorbed very slowly interepithelially, the salts of iron are taken up through the very cells, probably because the system requires iron so urgently.

The Influence of the Rennet Coagulation upon the Digestibility of Milk. Opinions have differed very widely as to the effect which the curdling of milk has on its digestibility. Thus, Sternberg² came to the conclusion that rennet retarded the digestion of milk, while v. Dungern advises the coagulation of milk by rennet before giving it to the children. Dr. Rudolf Popper here repeats the experiments and finds that the influence of the rennet coagulation upon the digestibility of milk by trypsin cannot be established.

The Composition and Properties of the Milk of the Donkey. Prof. Ellenberger³ finds that asses' milk becomes sour much later than cows' milk, for he could keep it sweet for several days in an open vessel at the ordinary temperature of the room. If asses' milk gets sour the casein falls gradually in very fine flocculi; only after ten to fourteen days hard coagula are formed. The ass's milk is more easily digested, not only because it contains more absorbable and soluble albumin and less fat and casein, but also on account of the fact just mentioned that during coagulation it forms very delicate flocculi which are easily dissolved in acids and after their digestion leave no insoluble pseudonuclein.

BLOOD, CIRCULATION AND RESPIRATION.

A New Apparatus for Counting the Blood Corpuscles. W. Bruenings⁴ could not confirm the assertion of Meissen and others that

¹ Archiv f. d. ges. Physiologie, Band xciv. S. 337.

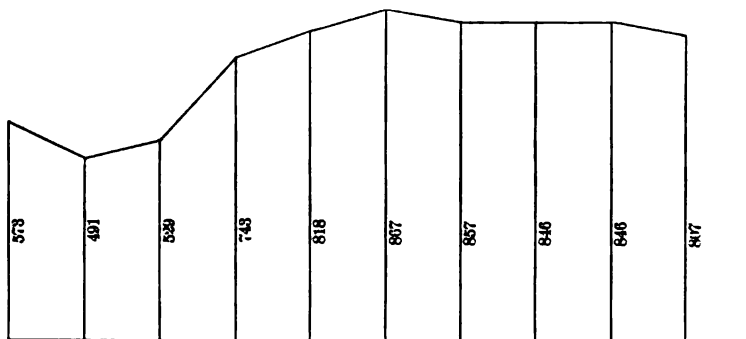
² Ibid., Band xcii. S. 605.

³ Archiv f. Physiologie, Supplementary Band 1902, S. 313.

⁴ Archiv f. d. ges. Physiologie, Band xcii. S. 377.

there exists a connection between the depth of the Thoma-Zeiss counting chamber and the atmospheric pressure; but he found two other important objections which interfere with the accuracy of the apparatus. Both refer to the unequal distribution of the blood corpuscles in the counting chamber. One cause of it lies in the fact that the drop of blood placed in the chamber has to spread, whereby the central parts of it remain at their place while the peripheral parts have to move to a relatively great distance. The other cause arises from the fact that a certain time elapses between the placing of the drop and laying down of the cover-glass, for it has been shown that the blood corpuscles begin to sink at once, and that in the solution used for counting the corpuscles sink at a rate of 20 mm. per hour or 0.006 mm. per second. If we suppose, therefore, that the height of a drop is about 0.5 mm. and that about ten seconds elapse before the cover-glass presses down the little column, the drop will consist of three distinct parts at the

FIG. 43.



end of that time. First, a layer of 0.06 mm. at the top, containing no blood corpuscles at all; second, a very thin layer at the bottom, which consists of all the corpuscles which have fallen down from the lower part of the drop up to a height of 0.06 mm., and, third, between them the remaining part with the normal number of corpuscles. The fluid part of the drop, therefore, contains now considerably less corpuscles, which must cause an unequal distribution, as the corpuscles at the bottom do not take an active part in the movement when the pressure of the cover-glass spreads the drop. The author proved this uneven distribution by actual photographs, and Fig. 43 illustrates the real numbers of corpuscles observed in a case in equal areas of the chamber from the centre to the periphery.

To avoid this unequal distribution of the corpuscles, Bruening had a new instrument made, an illustration of which is given in Figs. 44 and 45. The counting chamber (Fig. 44, cross-section) consists of a

glass tube, *a*, 4 cm. long and 8 mm. thick, with an inner diameter of 1 mm. From the thick wall of the capillary tube a lenticular piece, *b*, is ground out, which afterward is replaced by an accurately fitting lens, the apex of which slightly encroaches upon the lumen. On the apex a small facet is ground of about 1.5 mm. radius, which is divided into 400 square mm. A similar lens is placed in the opposite part of the tube, the facet of which, however, is not divided, and is placed at 0.200 mm. from the first. Thus, between the two facets a

FIG. 44.

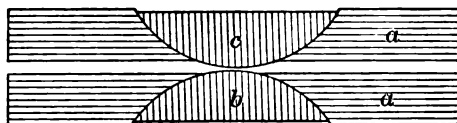
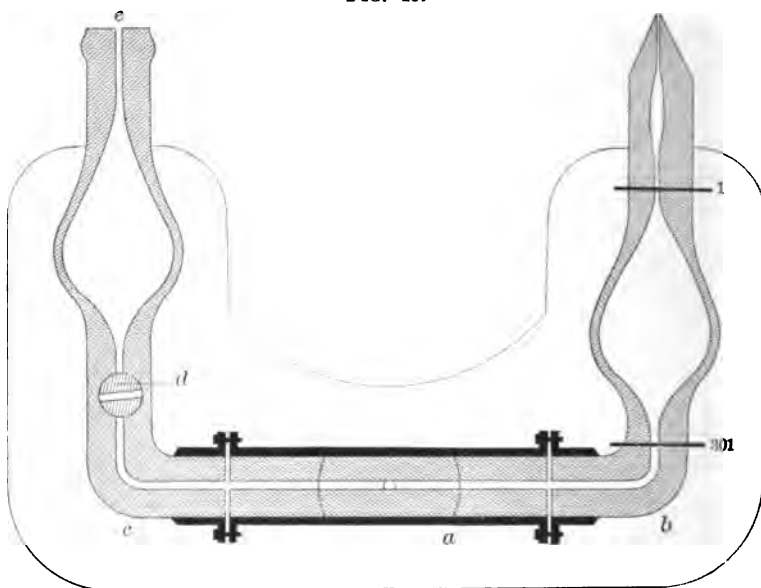


FIG. 45.



circular counting chamber is established, which has the diameter of the capillary tube and a depth of 0.200 mm. Fig. 45 shows a cross-section of the whole apparatus; *a* is the counting chamber to which by means of a metal tube the mixer, *b*, is added on the one, and the second mixer, *c*, with the suction tube on the other side. A stop-cock is seen at *d*. The whole apparatus is mounted on a metal plate, from which, however, it may be lifted when used.

∴ The great advantage of this instrument lies in the fact that the blood can be easily and most thoroughly mixed, it being drawn ten to twenty

times from the first mixer, *b*, to the second, *c*, and back. In the present construction it is a drawback that alcohol cannot be used in cleaning the capillary tube, because it would dissolve the shellac used for cementing the lenses to the tube, and that on account of the greater depth of the counting chamber and the thickness of the upper lens a magnification over 400 is excluded.

The Effect of Hemorrhage upon the Composition of the Normal Blood Compared to its Effect during the Administration of Iron and Arsenic. As a result of various labors in the past, we had a fairly complete knowledge of the effect of hemorrhage upon the hæmoglobin and the corpuscles, though observations upon the chemical changes produced in the blood were few and incomplete. With this in view Bauman¹ undertook a comprehensive experimental inquiry into the subject of the changes produced by hemorrhage both in the coloring matter and morphological elements, and in the chemical constitution of the blood. He further, for the purposes of comparison, investigated from the same standpoint the changes produced by hemorrhage upon the blood in cases in which iron and arsenic, singly and in combination, had been administered. He sums up as follows :

1. Hemorrhage produces a general deterioration of the blood and serum, especially of the former. The hæmoglobin is more diminished than the red corpuscles. The leucocytes are increased, the change consisting chiefly of an increase of the polymorphonuclear, occasionally of the mononuclear cells. The specific gravity of both blood and serum is less altered than the remaining factors. The solids, proteids, and total nitrogen of blood and serum are more or less equally affected. The qualitative change in the serum proteids consists in an increase of serum albumin at the expense of the serum globulin. The fibrin is increased and the coagulation rate shortened. The blood ash remains practically unchanged.

2. Hemorrhage during the administration of inorganic iron produces a general deterioration of the blood and serum, the latter being considerably less affected than by hemorrhage alone. The hæmoglobin is increased above its original value, while the red corpuscles are even more diminished than by hemorrhage alone. The leucocytes, both quantitatively and qualitatively, are affected as by hemorrhage alone. The same applies to the specific gravity of both blood and serum, and to the solids, proteids, and total nitrogen of the blood. The solids, proteids, and nitrogen of the serum are affected in varying degrees. The alterations in the fibrin and the coagulation rate correspond to those produced by hemorrhage alone.

¹ Journal of Physiology, *xxix.*, 1, p. 18.

3. Hemorrhage during the administration of organic iron produces alterations in the blood and serum closely resembling but less pronounced than those under hemorrhage and inorganic iron.

4. Hemorrhage during the administration of arsenic produces changes in the total blood which in every respect closely resemble those caused by hemorrhage alone, with the exception that the number of leucocytes is diminished instead of increased. The condition of the serum, however, resembles that produced by hemorrhage and inorganic iron—*i. e.*, it is better than under hemorrhage alone, but not so good as in hemorrhage and inorganic iron. The qualitative changes in the serum proteids correspond to those produced by hemorrhage alone—*i. e.*, the serum albumin is increased at the expense of the globulin.

5. Hemorrhage during the combined administration of iron and arsenic produces a degree of deterioration of the total blood which is much less marked than that produced either by hemorrhage alone or by hemorrhage during the administration of either of these drugs singly. A very slight deterioration is produced in the serum; in some respects, indeed, the change in the serum amounts to an improvement in the condition. The condition in the red corpuscle is better than in any of the other experiments. The hæmoglobin is very slightly diminished, but less so than by hemorrhage alone or by hemorrhage during the administration singly of iron and arsenic. Leucocytes are affected (although less pronouncedly) as by hemorrhage and arsenic alone.

The Behavior of Nucleated Colored Blood Corpuscles to Certain Hæmolytic Agents. On account of the numerous hæmolytic experiments done in connection with the investigations of the theory of immunity, Stewart's¹ paper on the behavior of nucleated colored blood corpuscles to certain hæmolytic agents, as the papers from the same laboratory by Peskind and Guthrie, are of especial interest. The reason for the experiments is stated by Stewart as follows:

Although some preliminary experiments had shown that nucleated and non-nucleated colored corpuscles exhibit the same general behavior toward NaCl, NH₄Cl, saponin, and water, it was thought of consequence to determine with as much exactness as possible how close the resemblance really is, for the following, among other reasons: 1. If the agreement turned out to be complete it would justify the use of mammalian blood, which has hitherto been alone employed in observations on the permeability of the corpuscles, in an investigation designed to throw light on the relation between the life and certain of the selective powers of cells, since nobody, whatever view he may hold in regard to the morphology of the non-nucleated corpuscle, can doubt

¹ American Journal of Physiology, 1902, viii., 2, p. 103.

that the nucleated corpuscle is a cell. 2. The comparison would not be without interest in connection with the morphological relationship of the two kinds of corpuscles. It would be interesting—*e. g.*, to determine whether the behavior of the nucleated corpuscles of the blood of the mammalian embryo was the same as that of the nucleated hæmoglobin-containing elements of the red marrow of the adult mammal, and the same as that of the nucleated corpuscles of the adult bird, and whether all the kinds of nucleated corpuscles resembled in their behavior the non-nucleated corpuscle of the mammal. Such investigations seemed not incapable of throwing light on the genetic relationship between them. Since the selection of NH_4Cl in preference to NaCl by the corpuscles depends on their physicochemical structure and not on what we call their life, and since some other cells, as pus corpuscles, do not possess this property, the question arises whether it is present all through the development of colored corpuscles, or is acquired at some definite point. 3. It seemed not unlikely that such a comparison might bring to light differences in the physiological properties of the nucleus and cytoplasm.

He divides his investigations into four sections, and summarizes as follows :

Section I. 1. Nucleated blood corpuscles like non-nucleated exercise a marked preference for NH_4Cl as compared with NaCl . This is the case even when the blood has been treated with formaldehyde, although the difference is less, especially when the conductivity is measured immediately after mixture. When the mixtures of formaldehyde blood with NH_4Cl and NaCl are allowed to stand, the difference increases continually with the time. Even when the substances were added to blood on which formaldehyde had already acted for twelve days, the difference was very distinct when the measurements of conductivity were made fifteen hours after mixture. The hardening action of the formaldehyde, accordingly, appears to render the penetration of the NH_4Cl into the corpuscles slower, or their power of binding it less, although it does not abolish their characteristic property of taking up NH_4Cl in preference to NaCl . The preference is equally marked in stale and in fresh blood. In birds' blood, therefore, as in mammalian blood, the preference does not depend on the life of the corpuscles.

2. Saponin produces a notable increase in the conductivity of fowls' blood, as it does in the conductivity of dogs' blood. An equal or even a somewhat greater increase is produced in both kinds of blood when saponin is added after the blood has been hardened by formaldehyde. This shows that the increase of conductivity is not dependent on or associated with the escape of the hæmoglobin from the corpuscles, since in the formaldehyde blood the hæmoglobin is fixed and the

saponin does not cause laking. As in the case of mammalian blood, the increase of conductivity is due to an increase in the permeability of the corpuscles to electrolytes.

3. The conductivity of fowls' blood is diminished by dilution with water to a much smaller extent than would be the case if serum or a solution of electrolytes were correspondingly diluted. This is due to the participation of the electrolytes of the corpuscles in the conduction of the current after the addition of water. The relative increase of conductivity is quite as well marked in formaldehyde-hardened as in fresh blood. Here, too, there is evidence that the electrolytes of the corpuscles participate in the conduction.

4. Heat-laking of fowls' blood is caused at about the same temperature as that of mammalian blood. The nuclei are not destroyed. The conductivity of fowls' blood may be markedly diminished by heat-laking, unlike that of mammalian blood. The action of saponin on the ghosts of heat-laked fowls' blood causes a marked increase of conductivity, and the action of water a marked relative increase of conductivity, just as in the case of mammalian blood.

Section II. 1. The nucleated colored corpuscles of the blood of the mammalian embryo behave in the same way as the non-nucleated corpuscles of the adult, to most of the laking agents investigated (sapotoxin, sodium taurocholate, amyl alcohol, water, foreign serum). On being heated to 63° to 65° C., they lake like the adult corpuscles, but, unlike them, leave few ghosts behind. Their nuclei also seem to be broken up by heat-laking, unlike those of birds' corpuscles.

2. All the hæmoglobin-containing elements of the red bone-marrow of a young mammal were found to behave in the same way as the adult mammalian colored blood corpuscles to the agents investigated (sapotoxin, water, solution of NH_4Cl).

The same was true of the colored corpuscles of the blood of a case of pernicious anæmia to sapotoxin, NH_4Cl solution, urea solution, and heat.

Section III. 1. Intraglobular crystallization of the hæmoglobin of necturus blood is very readily obtained by the action of various hæmolytic agents. The observations on this point show that the hæmoglobin cannot exist in the corpuscles in ordinary aqueous solution.

2. The various laking agents do not cause similar changes in the shape and size of the corpuscles and their nuclei.

3. Necturus corpuscles hardened by Hayem's solution are laked by H_2S without swelling of the nucleus. Ammonia causes great swelling of the nucleus.

4. By treating necturus corpuscles hardened by Hayem's solution successively with H_2S , NH_3 , and Löffler's methylene blue, and in other ways, an apparent envelope can be demonstrated.

5. Necturus corpuscles fixed by formaldehyde swell under the influence of NH_3 and heat, while the nuclei retain their original size. The same is true of corpuscles fixed by osmic acid. These facts indicate the existence of differences in the nature and point of attack of the fixation by different hardening agents.

Section IV. The permeability of the colored corpuscles for NH_4Cl does not depend on a toxic effect of the salt on the corpuscles.

In a later paper¹ Stewart shows the influence of cold on the action of some hæmolytic agents.

He claims that at 0°C . the laking action of sapotoxin is much retarded, and it can be shown that before any hæmoglobin has been liberated the conductivity of the blood is increased, presumably owing to an increase in the permeability of the envelopes of the corpuscles to electrolytes. At this stage sapotoxin has been fixed by the corpuscles. Bile salts produce the phenomenon less distinctly, foreign serum not at all.

Both at 0° and at ordinary temperature a dose of sapotoxin just sufficient to cause liberation of the hæmoglobin causes the discharge of only a small proportion of the electrolytes of the corpuscles. When the dose is increased the electrolytes are discharged.

It seems permissible to divide the action of sapotoxin on the corpuscles into three stages: 1. An action on the envelope which does not necessarily nor immediately lead to the liberation of the hæmoglobin. 2. An action on the hæmoglobin or the stromata which causes the discharge of the pigment. 3. An action on the stromata leading to the setting free of electrolytes.

The Action of Acids and Acid Salts on Blood Corpuscles and Other Cells. Two papers² by Peskind on this subject are of considerable utility in connection with hæmolytic experiments. He found that when a very small quantity of most acids or the acid of salts of iron, aluminum, zinc, copper, mercury, tin, silver, gold, uranium, and molybdenum is added to defibrinated human blood, dogs' blood, cows' blood, or the blood of a chicken, an immediate agglutination and precipitation of the blood corpuscles takes place. Neutral salts are unable to produce this reaction.

The serum constituents play no part in this reaction, since serum-free corpuscles are likewise agglutinated and precipitated by the same reagents.

The reaction is due to an effect of the reagents on the stromata of the corpuscles, since, if the serum-free corpuscles are laked by any hæmolytic agent—*e. g.*, sapotoxin—and to this solution of blood cor-

¹ American Journal of Physiology, 1903, ix., 2, p. 72.

² Ibid., 1902, viii., 2, p. 98, and 1903, viii., 5, p. 404.

puscles a trace of any of the precipitants is added the ghosts are agglutinated and precipitated, settling very rapidly.

The constituents of the stromata are, according to competent analysis, lecithin, cholesterin, and a globulin which, in all probability, exists as alkali globulin.

If blood corpuscles are laked by ether the lecithin and cholesterin are dissolved out of the stromata, yet the addition of any of the reagents still causes precipitation of the ghosts. Therefore, neither the lecithin nor the cholesterin is concerned in the production of this reaction. We must, therefore, look to the alkali globulin of the stromata for an explanation of the phenomenon.

The reagents which precipitate the stromata are also precipitants of alkali albumin and alkali globulin, and it seems a warranted conclusion that the reaction is due to a combination of the precipitant with the alkali globulin of the stromata.

A slight excess of the reagent causes precipitation of the corpuscles, but lakes them very rapidly.

Laking of the precipitated corpuscles may be prevented by washing several times with ice-cold saline solution and centrifugalizing after each washing. Keeping precipitated blood at 0° C. (*i. e.*, without washing) retards laking for a long time.

More than a slight excess of reagent prevents agglutination and precipitation of the corpuscles.

If corpuscles precipitated by HCl or FeCl₃ are washed five or six times with ice-cold saline solutions (centrifugalizing after each washing) the corpuscles will then, on being shaken with saline solution, resume a practically normal suspension, from which they can be reprecipitated by the ordinary agents.

All acids and acid salts cause precipitation of alkali globulin, but certain acids and acid salts do not precipitate stromata and intact blood corpuscles. Intact corpuscles were found not to be precipitated by osmic acid, boric acid, uric acid, hydrogen sulphide, carbonic acid, arsenious acid.

The only acid salts which would precipitate intact corpuscles were those mentioned in the first paragraph, including the acid sulphates of sodium and potassium.

Why certain acids and acid salts do not precipitate the stromata and the intact corpuscles is difficult at present to say. It will, perhaps, be found that the impenetrability of the corpuscles for a given acid salt determines whether or not this reagent will cause agglutination and precipitation of the corpuscles. If this be the case, then we have a ready means of determining whether any given metallic base penetrates the corpuscles—*i. e.*, by seeing whether the acid salts of this base cause

precipitation of the corpuscles. There is reason to believe that in this reaction the reagents do not penetrate the corpuscles to any great distance, but combine with the envelope and remain close to the surface. The envelope is made sticky, which accounts for the agglutination.

Leucocytes, thoroughly washed, are strikingly agglutinated and precipitated by the same reagents which act on red blood corpuscles. The blood, separated into two layers—an upper milky layer of serum containing a larger number of leucocytes and absolutely no red cells, and a lower layer containing the red cells and some leucocytes. Some of the upper leucocytic layer was diluted with saline solution centrifugalized and washed. The sediment, consisting purely of leucocytes, was used in the experiments.

Halliburton has shown that leucocytes contain the same globulin (called by him β -globulin) as the stromata of the red corpuscles. (This globulin is found to have fibrinoplastic properties.) The reaction in the case of leucocytes (*i. e.*, the agglutination and precipitation) is, therefore, in all probability due to a combination of this β -globulin with the reagents.

This globulin is a constituent of all typical cells—*e. g.*, liver cells, kidney cells—and reasoning by analogy from the chemical constitution of the stromata (which form the framework of the red blood corpuscles) he believes that this globulin forms a part of the framework, or at least the envelope of all these typical cells. If this be so then the reaction (*i. e.*, agglutination and precipitation) must show itself to be of a general nature and not confined to blood corpuscles. On trial this was found to be actually the case. Spermatozoa, yeast cells, bacilli, the mycelia, and spores of a fungus and ciliated epithelium were all found to give the reaction.

Spermatozoa, washed free from spermatid fluid, are agglutinated and precipitated by ferric chloride, although the reaction was not obtained with copper sulphate or HCl.

Yeast cells show marked agglutination and precipitation if they are suspended in saline solution and then treated with a little ferric chloride. A solution of peptone in 0.9 per cent. saline was inoculated with a motile bacillus. After several days the bacteria were centrifugalized and washed several times with saline. The bacilli, suspended in saline, were immediately agglutinated and precipitated by small amounts of ether, ferric chloride, or hydrochloric acid solution.

A fungus rubbed up in saline solution gave a suspension of mycelia and spores which under the microscope showed practically no clumping. On the addition of ferric chloride a flocculent precipitate consisting of agglutinated masses of mycelia and spores came down.

Ciliated epithelial cells from the larynx of a rabbit, suspended in

saline solution, are agglutinated and precipitated by ferric chloride. One specimen of leukæmic blood investigated contained in its serum an isolysin—*i. e.*, a substance which caused laking of human colored corpuscles. This blood serum also caused agglutination of human blood corpuscles as well as agglutination, precipitation, and laking of dogs' corpuscles.

Experimental Researches about the Effect of Camphor on the Heart and the Vessels of Mammals. Dr. H. Winterberg¹ performed his experiments on rabbits, cats, and dogs, and comes to conclusions which in many points are quite different from the views current in the medical profession. His researches give no support for a direct favorable influence of camphor on the cardiac activity, and further show that a stimulation of the vascular nerve centre in the medulla can be observed only rarely. The more regular periodic increases of blood pressure occur only after such large doses that they cannot be expected after safe therapeutic doses. He admits, however, that his observations do not justify an entirely negative judgment on the therapeutic value of camphor. For apart from the stimulation of the cerebrum and the respiratory centre, which latter shows itself in an acceleration and deepening of the inspirations, the power of camphor as a vasodilator may under certain circumstances be of the greater importance for the distribution and the circulation of the blood, as not all the vascular areas are equally affected, but especially those of the jugular and femoral veins, those of the splanchnic area showing no dilatation. It may be that the temperature-reducing effect of camphor as well as the fact that after camphor injections the formerly hardly perceptible pulse becomes more vigorous again, are to be traced to such a dilatation of the vessels.

About the Supposed Inability of the Lake-colored Blood to Nourish the Heart Muscle. Several physiologists have shown that the excised heart of the frog may be kept active with diluted blood of mammals for a long time, while lake-colored blood—that is, blood in which the erythrocytes have been dissolved and the hæmoglobin has passed into the serum—does not possess this power or only to a very slight degree. Kronecker thought that the cause was a poison developed by the destruction of the red blood corpuscles, and Heffter believed that for a sufficient supply of oxygen the erythrocytes must be perfect. O. Langendorff² now shows that the potassium present in the red blood corpuscles acts like a poison upon the heart. This poison could not exert its poisonous action before, because the living erythrocyte does not allow the deleterious potassium to enter the serum of the blood.

¹ Archiv f. d. ges. Physiologie, Band xciv. S. 455.

² Ibid., Band xciii. S. 286.

Animals, therefore, which have only a small amount of potassium in their blood corpuscles do not show this phenomenon. This is the reason that the hearts of cats, though excised, may be kept in good and regular activity for several hours by the lake-colored blood of other cats, although the pulse is not quite as strong as when the heart is nourished by equally diluted normal blood of the same animal.

THE EFFECT OF LAKE-COLORED BLOOD UPON THE ISOLATED FROG'S HEART. E. Brandenburg¹ experimented with the blood of cats, dogs, goats, calves, sheep, pigs, horses, guinea-pigs, rabbits, and men. He confirmed the work of Langendorff, who had found that the poisonous lake-colored blood owed its deleterious effect only to the high amount of potassium contained mainly in the red blood corpuscles. How much the blood of different animals may differ with regard to the amount of potassium is best shown by the blood of the rabbit, which contains about twenty times more of it than that of the cat. It was further shown that the poisonous effect of the potassium salts of the lake-colored blood could be neutralized by the addition of Ca salts.

Ventricular Systole and Pulse Curve. Karl Schmid² sums up his researches in the following sentences: 1. The primary elevation of the (sphygmographic) pulse curve is caused by a centrifugal push wave which is the consequence of the sudden commencement of the systolic expulsion of blood from the ventricle. 2. The first secondary elevation arises from the arterial increase of pressure which likewise spreads wave-like into the periphery and which is caused by the gradual further expulsion of the ventricular blood into the aorta. 3. The second secondary elevation is the expression of the tension wave from the closure of the aortic valves. 4. The oscillation of the arterial blood pressure is shown most correctly by those pulse curves which are obtained with the least load of the receiving pelotte, because in this manner we avoid a hurling of the writing lever and a disturbance of the circulation in the artery examined.

The Bronchial Muscles, their Innervation and the Action of Drugs upon Them. A valuable contribution to the physiology of the lungs is given by Dixon³ under this title. His principal findings were as follows:

The bronchoconstrictor fibres run in the vagus; none are found in the sympathetic; there is no central tonic effect.

Contraction of the bronchioles may lead to collapse or overdistention of the lung, depending upon the force of the inflation on the one hand and the time allowed for deflation on the other.

¹ Archiv f. d. ges. Physiologie, Band xcv. S. 625.

² Ibid., Band xci., Heft 5 und 6.

³ Journal of Physiology, 1903, xxix., 2, p. 97.

In the dog and rabbit typical bronchiolar constriction immediately follows vagal stimulation. In the cat the common response is a preliminary slight constriction followed by recovery, and the typical constriction only comes on some seconds after the stimulus has ceased.

The vagus contains bronchodilator fibres as well as bronchoconstrictor, and the former are particularly well developed in the cat, thus yielding an explanation of the anomalous results seen in this animal.

The sympathetic contains no bronchodilator fibres.

The presence of bronchodilator fibres is most readily demonstrated by excitation of the vagus, after an artificial tonus has been set up by means of muscarine, pilocarpine, etc. The bronchodilatation dies away soon after the stimulus ceases.

Both the constrictor and dilator fibres in the vagus supply the lung on the same side only.

The inhalation of ether or chloroform for anæsthetic purposes abolishes the effect of the vagus on the bronchioles. This is due to the paralysis of the nerve-endings by direct absorption through the mucous membrane.

Excitation of the vagus leads to a diminution in amount of the blood in the lungs. This produces increased distensibility—diminished “Lungenstarrheit” in v. Basch’s sense.

Reflex bronchiolar constriction is best obtained by exciting the nasal mucous membrane. Little or no result was obtained by stimulating the sciatic, central vagus, superior laryngeal, or cornea.

The condition of the bronchioles and any alteration in their contraction can also be determined by recording the rate of distention or of retraction of the lung.

Typical bronchiolar contractions by stimulation of the vagus can be obtained in animals recently killed by bleeding. Some constriction can even be obtained thirty minutes after death.

Gradual constriction of bronchioles followed by dilatation is usually seen post-mortem.

Muscarine, pilocarpine, and physostigmine excite the vagal endings and induce typical bronchiolar constriction. The effect is abolished by atropine.

Barium, veratrine, bromine, and the salts of many of the heavy metals (*e. g.*, gold) produce constriction which is not influenced by atropine.

Inhalation of CO₂ leads to constriction of the bronchioles which is not altogether central in origin.

Chloroform, ether, urethane, lobelia, and atropine induce dilatation of the bronchioles when constriction is present. The dilatation produced by lobelia is quite transient, while that by atropine is permanent.

Studies on the Influence of Artificial Respiration upon Strychnine Spasms and Respiratory Movements. It is now a well-established fact that artificial respiration may prevent the outbreak of convulsions due to strychnine poisoning or may inhibit them if already present, provided the dose of strychnine be not too large. The striking feature of its action is the perfect relaxation of the convulsed muscles, and absence of any muscular rigidity or any kind of tremor. Artificial respiration here, apparently, inhibits the artificial increase of reflex irritability.

The reason of this inhibition was made the subject of study by Gies and Meltzer.¹ Their first series of experiments brought out one positive result. The claim of Brown-Séquard, that section of the cord or of the vagi abolished the arresting influence which artificial respiration exerts upon strychnine spasms, is entirely unfounded. Not only does section of the vagi alone, or of the cord alone, fail to impair this influence, but even cutting the vagi, combined with such section of the cord as excludes all influence of the splanchnic, diaphragmatic, and thoracic nerves, apparently does not interfere with the inhibitory influence of artificial respiration upon strychnine spasms. There were no convulsions in their experiments as long as sufficiently strong artificial respiration was administered. In many experiments no convulsions appeared even after the artificial respiration was stopped, although in all cases doses of strychnine were employed which by control experiments were proved to be surely toxic and mostly fatal. In some experiments artificial respirations arrested instantly the tetanic convulsions which were permitted to break out.

Respiration in Air and Oxygen during Dyspnœa and Eupnœa. By means of an improved pneumographic method which makes use of the means and procedures of Hering, Gad, and Rosenthal, Cowl² could show that in rats and rabbits with tissue dyspnœa in consequence of intoxications and of prolonged interference with the action of lungs and respiratory centre there takes place a considerable diminution in the respiratory effort and volume during the transition from the breathing of atmospheric air to that of air rich in oxygen and inversely. In healthy animals, however, in eupnœa no change in the respiratory movements occurs during such transition.

GLANDS AND SECRETION.

The Effects of Intravascular Injections on Extracts of Animal Tissues. We are in accord with Vincent and Sheen,³ that, whenever

¹ American Journal of Physiology, 1903, ix., 1, p. 3.

² Archiv f. Physiologie, Supplementary Band, 1902.

³ Journal of Physiology, 1903, xxix., 3, p. 242.

an extract of a tissue introduced artificially into the circulation produces a distinct physiological effect, the production of a substance or substances with a similar effect is not necessarily one of the normal functions of the living tissue. At the same time we are willing to allow that a general survey of the results produced upon a living animal by the injection into its vascular system of various tissue extracts is likely to be of some value, both in regard to observations of the general physiological effects induced and the specific physiological effects of tissue upon tissue.

It has been shown that all glandular tissues and probably all animal tissues contain both a pressor and a depressor substance, the former being usually extracted by saline solution at ordinary temperatures, while the latter is extracted by boiling saline solution, which either destroys (wholly or partly) the pressor substance or masks its effect by producing more of the depressor substance.

The findings of Vincent and Sheen are as follows :

Nervous Tissue. Extracts of nervous tissues produce a marked temporary fall of blood pressure, which occurs after section of both vagi and after doses of atropine sufficient to completely abolish vagus action. Since choline always produces a rise of blood pressure after atropine administration it cannot be the active principle of nervous tissue extracts (confirmatory of Osborne and Vincent). The depressor substance in nervous tissues is found in physiological saline decoctions, in alcoholic extracts dissolved in normal saline, and in other extracts (dissolved in normal saline) of the alcoholic extracts. The depressor substance is not, however, extracted direct from the moist tissues by ether.

There is distinct evidence of the presence of a second active principle in nervous tissue extracts which produces a pressor effect. This, indeed, is the usual effect of an extract made with normal saline at ordinary temperatures. (Proteid extract.)

Muscular Tissue. All kinds of muscular tissue contain a depressor substance not usually so marked in its effects as that contained in nervous tissue, but like it equally active after the administration of atropine. A pressor substance appears also to be present which is best extracted by normal saline at ordinary temperature.

Kidney Tissue. There is abundant evidence of pressor and depressor substances in kidney tissue. As with other tissue extracts, the pressor effect is more readily produced by extracts made at ordinary temperatures, but occasionally by saline decoctions.

Other Tissues. Many other animal tissues contain a depressor substance, as the liver, spleen, testis, pancreas, ovary, lung, and the intestine. In fact, it is possible that all animal tissues contain different

substances which when injected into the circulation produce respectively either a rise or a fall of the blood pressure.

The falls and rises of blood pressure are produced by vasodilatation or vasoconstriction of various vascular areas in the body, but further investigation is required before we can state definitely that there is any specific effect of a particular extract upon the tissue from which it arises.

The Share of the Central Vasomotor Innervation in the Vasoconstriction Caused by Intravenous Injection of Suprarenal Extract. Doubting conclusions obtained by the plethysmograph in such an investigation, S. J. Meltzer and Clara Meltzer¹ employed direct inspection of the bloodvessels, following Oliver and Schaefer. They used the rabbit's ear. The condition of the bloodvessel there is easily discernible, and the vasomotor influence of central origin can be satisfactorily removed. Furthermore, the conditions of the bloodvessels of the ear deprived of the vasomotors can easily be compared at any stage with those of the normal ear, and this can throw light on the share which the central vasomotor mechanism may have in the vasoconstriction caused by the suprarenal extract.

They first removed the superior cervical ganglion, and cut the third cervical nerve and its connecting branches on one side, which deprives the bloodvessels of the ear on the operated side of all central innervations. The experiments with intravenous injections of adrenalin into rabbits thus operated brought out the following results:

1. The degree of constriction which the bloodvessels attain in the ear on the operated side is about the same as that of the ear on the normal side.
2. The constriction, however, sets in later and develops more slowly on the operated side than on the non-operated side.
3. On the normal side the constriction is usually followed by a moderate but distinct vasodilatation. Such an after-effect is absent on the operated side.
4. On the operated side the constriction lasts considerably longer than on the non-operated side.

From these observations the conclusion is drawn that in the normal animal the injected suprarenal extract stimulates, in the first place, the vasomotor centres. It stimulates the constrictors as well as the vasodilators, but when the extract is present in the blood in a sufficient dose it favors constriction, which sets in quite abruptly, and develops rapidly. The further continuation of the constriction is possibly also supported by the stimulation of the peripheral mechanism. When,

¹ American Journal of Physiology, 1903, ix., 3, p. 147.

after a few minutes, the dose of the extract within the blood becomes diminished the stimulation of vasodilatation is now favored, and the constriction soon disappears, giving way in some places even to some degree of vasodilatation. In the absence of central innervation the vasoconstriction is accomplished by the peripheral mechanisms, which react more slowly to stimulation by the extract, but whose final restricting effect lasts for a considerable time, since it cannot be interrupted by a central vasodilatation.

On the Nature of Adrenalin Glycosuria. Noel Paton,¹ in a series of experiments, practically confirms Blum and Zuelzer's results. He concludes that the subcutaneous administration of adrenalin in dogs and rabbits causes a true glycosuria and glycæmia, the degree of which depends largely upon the amount of carbohydrates in the body, but which occur when stored carbohydrates have been eliminated. The glycosuria is apparently due to a diminished utilization of sugar in the tissues, since it is not due to a mere increased formation of glucose or to increased excretion of sugar by the kidneys.

That the effect is due to a toxic action of the adrenalin and not to interference with the processes of oxidation caused by the vascular changes is indicated, first, by the extent of the glycosuria, which is far more marked than that observed as the result of mere interference with oxidation, and, secondly, by the fact that the glycosuria is slight in guinea-pigs, where the vascular changes are much more prominent.

He found, further, that during the prolonged daily administration of adrenalin days may occur on which sugar does not appear in the urine, and that a distinct tolerance to the drug may be established. He was unable to detect diacetic acid and acetone in the urine of dogs, but a dark-red ring at the junction of the urine with nitric acid was constantly present.

The study of the proteid metabolism showed (1) that the sugar is not entirely derived from the breaking down of proteids; (2) that there is a markedly increased production of ammonia, and (3) that on an insufficient diet the decomposition of proteids is markedly increased, while the absorption of proteids is not interfered with. The proteid metabolism under adrenalin thus behaves as it does in ordinary diabetes.

An Experimental Study of the Sugar Content and Extravascular Coagulation of the Blood after Administration of Adrenalin. It has long been known that the glycosuria produced by extirpation of the pancreas, puncture of the floor of the fourth ventricle, and poisoning with certain substances, such as carbon monoxide, is the immediate result of an increased accumulation of sugar in the blood. On the

¹ Journal of Physiology, 1903, xxix., 3, p. 286.

other hand, injections of phlorhidzin are followed by the excretion of sugar due to the effect on the kidney. In the latter case the percentage of sugar in the blood never rises above normal, and may even fall below that amount. To determine in which class adrenalin glycosuria belongs Vosburgh and Richards¹ made a number of determinations of the sugar content of the blood of dogs, which had been subjected to treatment with adrenalin. In this series they also attempted to ascertain the rapidity with which this substance acts and the course and duration of its influence. They found that the intraperitoneal injection of adrenalin chloride as well as the application of that substance to the pancreas gives rise to a marked increase of sugar in the blood. This hyperglycæmia makes its appearance immediately after the administration reaches its maximum in from one to three hours, and may continue for over fourteen hours.

Simultaneously with hyperglycæmia there occurs a decided diminution of the time of extravascular coagulation of the blood. This phenomenon appears to be due to the application of adrenalin to the pancreas.

The cause of this form of hyperglycæmia, as indicated by comparative analysis of the blood flowing from the liver, is to be attributed in great part at least to an increased sugar formation in that organ.

On the Products of the Proteolytic Action of an Enzyme Contained in the Cells of the Spleen. That the spleen cells contain a proteolytic enzyme, which acts far more powerfully in an acid medium (0.2 per cent. acetic acid) than either in a neutral or alkaline one, was recently shown by Hedin and Rowland.

A similar if not identical enzyme was shown by them subsequently to be present in the cells of other organs—lymphatic glands, kidneys, liver, heart muscle—while in the voluntary muscles the enzyme found acts equally in acid, neutral, and alkaline fluids, but was comparatively inactive in all.

In order to determine what the nature of the nitrogenous products of the enzyme action are Leathes² investigated in the first place the solution obtained from the action of filtered ox-spleen juice upon large quantities of fibrin, and, secondly, also the fluid juice after it had been kept for some weeks at the body temperature under a layer of toluol, without the addition of fibrin, but with, in each case, the addition of 0.2 per cent. acetic acid. He found that the products of the action in the acid medium of this proteolytic enzyme are the same as those found to be formed by trypsin in alkaline media or those formed by the hydrolytic action of mineral acids.

¹ American Journal of Physiology, 1903, ix., 1, p. 35.

² Journal of Physiology, 1902, xxviii., 5, p. 360.

The Mechanism of the Retention of Chlorides: A Contribution to the Theory of Urine Secretion. Three theories have been advanced to account for the retention of the chlorides in cases in which they are absent from the urine, namely, in infectious diseases, in salt starvation, and on intravenous injection of Na_2SO_4 solution. One theory assumes that no chloride is filtered; another that the chlorides are filtered in the glomeruli, very much as when retention does not occur, but that the chloride is reabsorbed. The third, which grants to the glomerular cells the property of vital secretion, assumes that these cells secrete no salts when the proportion of salts in the blood falls below a certain amount.

These explanations involve respectively the theories that the urinary salts are filtered, reabsorbed, and secreted. Each of these theories has been called into doubt, so that the study of the question of chloride retention offers a peculiar interest and might be expected to throw light on the whole subject of urine secretion.

The investigations of Sollman¹ throw us back on the adjective vital. He found that the disappearance of chlorides from fever urines is due practically entirely to the deficiency of chloride income. It cannot possess any diagnostic value. The mechanism of the retention of chlorides is not explained by any physical theory, but must be a vital process. Lessened secretion and increased reabsorption are probably both concerned in the retention. The filtration theory of urine formation is inadequate and a vital secretion process must be assumed.

The Effect of Diminished Excretion of Sodium Chloride on the Constituents of the Urine. In somewhat the same connection, but in another paper, Hatcher and Sollman² show that the disappearance of the chlorides from the urine does not lead to any very large changes in the other urinary constituents—not sufficient at least to alter the physical properties of this fluid. Nor does the administration of sodium chloride produce such changes. They draw attention, however, to several practical considerations which are suggested by their results.

According to the school of v. Koranyi, heart diseases can be diagnosed from a high $\frac{\Delta}{\text{NaCl}}$ joined with a low $\Delta \times \text{c.c.}$ Their results show that the same change is produced in at least an equal degree by milk diet. Unless due value is given to this fact a mistake in diagnosis may easily occur.

The addition of sodium chloride to a milk diet results in a greater excretion of urine and of metabolites. The latter are at the same time diluted. The retention of chlorides shows further that the body

¹ American Journal of Physiology, 1902, viii., 3, p. 155.

² Ibid., viii., 3, p. 139.

requires a certain amount of sodium chloride which is not supplied by the insufficient quantity of this substance contained in the milk. For these reasons the addition of sodium chloride to a milk diet appears commendable. The salt may be added directly to the milk without inconvenience. It should be distributed so that about fifteen grammes are taken per day.

MUSCLES. NERVES. SPECIAL SENSES.

Contributions to the General Physiology of Muscles and Nerves.

E. Overton,¹ of Würzburg, has made very interesting researches as to the indispensableness of sodium (or lithium) ions for the contraction of the muscle and has come to the following conclusions :

1. If muscles are placed in solutions of cane-sugar or of other non-electrolytes for which the muscular fibres are impermeable, these solutions having been made isosmotic with blood, they after a little while lose the power of contracting and propagating the excitations.

2. This inexcitability of the muscles is caused by the exosmosis of the sodium chloride from the fluid which surrounds the single muscular fibre.

3. The nerve trunks do not lose their excitability by their stay in pure solutions of sugar.

4. The excitability of muscles which have become inexcitable by their long stay in saccharine solutions returns gradually after adding a small amount of chloride of sodium to the solutions.

5. The inexcitable condition is not caused by an increase in the electric resistance from the withdrawal of the sodium chloride, because the muscles are just as inexcitable toward mechanical stimuli.

6. In 6 per cent. solutions of cane-sugar, etc., which contain about 0.1 to 0.12 per cent. chloride of sodium, the muscles remain excitable just as long as in 0.6 to 0.7 per cent. chloride of sodium.

7. The lowest amount of chloride of sodium of a solution which is just sufficient to keep the muscles perceptibly excitable is 0.07 to 0.003 per cent.

8. The chloride of sodium may be replaced by all non-poisonous salts of sodium. The maintenance of the excitability of the muscles depends, therefore, almost undoubtedly upon the sodium ions, while the anions (and electrically neutral molecules) play only a passive part.

9. Sodium salts may be replaced by lithium salts, but not by those of potassium, rubidium, cæsium, ammonium, magnesium, calcium, strontium, or barium.

¹ Archiv f. d. ges. Physiologie, Band xcii.

10. The part which the sodium and lithium ions play in the propagation of the excitation and the contraction of the muscles cannot be explained as yet. It may be that during these processes there takes place a certain exchange between the potassium ions of the muscle fibres and the sodium ions of the surrounding solution.

About Functional Changes in the Muscles of Warm-blooded Animals during Want of Oxygen. Dr. Camill Lhotak von Lhota¹ made his experiments on rabbits, in which he produced more or less asphyxia in order to study its effect on the muscles. He sums up his conclusions as follows: 1. The want of oxygen rapidly lowers the function of the muscles of warm-blooded animals, sometimes down to zero. Such lowering of the irritability occurs also if during the asphyxia the muscle is not active. 2. The lowering of the function is certainly only transitory, for the muscle can still contract a long time after the heart has stopped. 3. The function of the asphyxiated muscle is restored to a certain degree by itself, which may be hastened by mechanical interferences, especially by a renewed supply of blood rich in oxygen. 4. By the blood rich in oxygen the asphyxiated muscle may recover up to the original degree of functional activity. 5. Muscles of weak, lean animals and such that have passed repeatedly through asphyxia show none or only a small lowering of the functional activity.

The Immediate Influence of Exercise upon the Irritability of Human Voluntary Muscle. Storey² made a series of investigations to discover if the preliminary "warming up" movements practised by athletes before a competition test was physiologically justified. His experimental procedure may be outlined as follows: A single small muscle was substituted for the many groups that participate in normal exercise. The condition of the muscle was made evident by the amount of its contraction in response to the single break-induced current. The muscle was exercised, "warmed up" by voluntary work with an ergograph, and the influence of that work upon the condition of the muscle was then tested by means of the break current.

The experiments presented make it evident that human voluntary muscle is made more irritable by successive excitations; that the irritability of human voluntary muscle is immediately very greatly increased by a moderate amount of work, and that it is very greatly decreased by a fatiguing amount of work.

It may be concluded that the "warming up" habits referred to are, therefore, of value in athletic contests, because by such means the irritability of the acting muscle groups is greatly heightened, and they are

¹ Archiv f. d. ges. Physiologie, Band xciv. S. 622.

² American Journal of Physiology, 1902, ix., 1, p. 52.

then able to attain more quickly their maximal strength and speed of contraction.

Muscular Contraction and the Venous Blood Flow. Two distinct groups of variations in the venous blood flow are recognizable. The first group embraces those variations in the blood volume which occur periodically, either with the changes in intra-auricular pressure during each cardiac circle or with the changes in intrathoracic pressure during each respiratory phase. The second group embodies all those variations which are dependent upon accidental, mechanical causes and do not appear at regular intervals. The latter may, therefore, be termed "irregular" variations.

Leaving out of consideration those obvious changes in the venous flow which result from external mechanical influences, Burton-Opitz¹ deals with only the most important class of variations of the latter type, namely, those produced by the contraction of skeletal muscles.

Briefly outlined, the method consisted in determining quantitatively the volume of the blood flow, first under normal conditions and subsequently during the different stages of muscular contraction. The femoral vein was used in these experiments, because this vessel is easily isolated and drains a complex of muscles, the nerves of which are readily accessible to the electrodes. He concludes as follows :

The value of the blood flow measured in nine dogs varied from 0.50 c.c. per second to 1.20 c.c. per second. The average flow was 0.85 c.c. per second ; average weight of dog, 14.2 kilos.

The velocity of the blood stream varied from 48.5 mm. per second to 74.7 mm. per second ; average velocity 61.6 mm. per second.

Compression of the femoral artery caused a reduction in the blood volume of from 63 to 90 per cent. ; average decrease, 75 per cent.

Section of the nerves innervating the posterior extremity as followed by an increase in the blood volume of from 2.6 to 3.1 times the normal value ; average increase, 2.8 times.

The variations in the venous blood flow accompanying a tetanic muscular contraction may be divided into three periods : 1. Period of great flow, synchronous with the muscular shortening. 2. Period of slight flow, continuing during the contracted state of the muscles. 3. Short period of increased flow, following the relaxation of the muscle.

Differences in the force of the muscular contraction do not alter the general character of the variations, but only cause changes in the amplitude of its various details.

If single induction shocks are used a great increase in the flow results during the periods of rising energy of the muscle. Between the twitches the blood flow resumes its normal value.

¹ American Journal of Physiology, 1903, ix., 3, p. 161.

The venous pressure changes during a tetanic contraction in a corresponding manner. There is a quick rise during the muscular shortening and an almost equally rapid fall after the maximal contraction has been reached. During the first part of the tetanization the pressure remains slightly below normal, while during its latter part the pressure gradually rises and continues slightly above normal for a short time after the relaxation of the muscle.

Alcohol and Muscle Strength. From his ergographic experiments, performed by Prof. Dubois and Dr. Schnyder¹ on themselves, the latter draws the following conclusions: 1. Alcohol, if taken in small quantity, has a favorable effect upon the strength of the muscles when the stomach is empty, and in consequence of the individual conditions the store of bodily energy has been to a certain degree exhausted. 2. This favorable effect, however, is outbalanced by that of a food stuff of equal caloric value. Furthermore, it is diminished by the paralyzing effect of alcohol upon the nervous system, which effect, according to the physiological state of the person experimented upon—shows itself in a more or less disturbing manner and may lead to apparently contradictory results. 3. When, however, by other food sufficient energy is provided for, alcohol is of no value; on the contrary, its paralyzing effect alone then shows itself and leads to a decrease of the working capacity.

The Relations between the Height of the Lift and the Duration of the Contraction during Fatigue of the Muscle. Dr. A. Lohmann,² from his experiments on the gastrocnemius of the frog, concludes as follows:

1. The prolongation of the time of contraction which occurs during the fatigue of this muscle may be prevented solely by warming the muscle to about 34° C. Inversely strong cooling of the muscle causes an increased prolongation of the time of contraction.

2. The prolongation of the time of the contraction does not occur, even in the ordinary temperature of the room during the fatigue of the excised muscle, if the interval between the single stimuli is made sufficiently great; the decrease, however, in the height of the lift remains as before.

3. If after a number of stimulations a longer pause occurs, the time of contraction recovers during this pause completely, independently of the height of the lift.

The Spinal Origin of the Cervical Sympathetic Nerve. In this regard Herring³ supports Anderson. He finds that after section of the cervical sympathetic in the neck of the cat chromatolysis and atrophic changes take place in the spinal cord in the cells of the lateral horn of the same side. The cells affected begin above at a level corresponding

¹ *Archiv für Physiologie*, Band xciii., S. 451.
³ *Ibid.*, Band xciii., 3, p. 282.

² *Ibid.*, Band xci. S. 338.

to the superficial origin of the eighth cervical nerve, are most numerous in the second and third thoracic segments, then decrease in number to the sixth thoracic. The cells are multipolar, larger, and more rounded in the gray matter of the lateral horn, smaller and spindle-shaped where they lie among the white fibres of the lateral columns.

The Function of the Accessory Organs of the Sympathetic Nerve (Zuckerkandl) and the Chromophilous Cells.¹ While investigating the retroperitoneal space of newborn children and embryos, E. Zuckerkandl regularly found two bodies near the aorta where the inferior mesenteric artery is given off. These bodies, which hitherto had been confounded with neighboring lymphatic nodules, but differ from them by form, color, and histological build, were called by him "accessory organs of the sympathicus." They have a connective-tissue capsule within which the numerous bloodvessels form a capillary network in the inter-spaces of which the real organic cells are found. These cells are arranged in groups or series, are of different sizes, and possess the property of coloring brown with chromic acid and its salts. Regarding the function of these organs Arthur Biedl and Josef Wiesel have made many experiments on dogs and rabbits, and have come to the following conclusions :

The extract of the accessory organs of the sympathicus, like that of the suprarenal bodies of the selachians, when given by intravenous injection has essentially the same effect upon the circulation as belong to the so-called adrenal extract. The morphological basis of this common effect is formed by a tissue formation common to these organs which is characterized by the histological property of being chromophilous, being derived from "sympathetic formation cells." The chromophilous cell-groups form an internally secreting tissue, distributed through the body, and in the adult especially accumulated in the adrenal bodies. Its activity consists in the production of a well-characterized substance which stimulates the muscles and the nervous system.

About the Functions of the Cerebellum. Dr. M. Lewandowsky² goes through the whole literature of this subject and gives the result of his critical and experimental work, the latter performed on dogs and monkeys. He has observed astasia, atony, and asthenia, the main symptoms of sensory ataxia, as the consequence of the lesions of the cerebellum, and he considers all disturbances of motility after lesions of the cerebellum as caused by disturbances of the muscular sense, which has its main seat in the cerebellum. "Cerebellar ataxia is a sensory ataxia. It depends upon a severe disturbance of the muscular sense which causes the loss of the faculty to regulate the movements and to adjust the relative strength and velocity and the sequence of the

¹ Archiv f. d. ges. Physiologie, Band xci., S. 434.

² Archiv f. Physiologie, 1903, Heft 1 and 2.

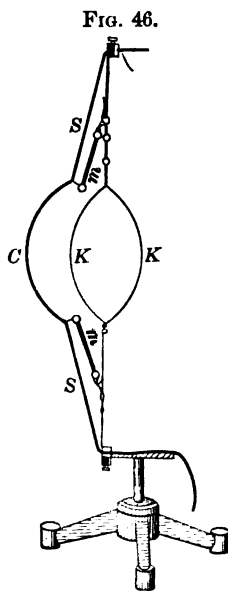
singly or synergetically connected muscle contractions. For this reason the movements receive the distinct character of aimlessness." He does not claim, however, that the cerebellum is the only seat of the muscular sense, but thinks that other parts of the central nervous system and especially the cerebral cortex receive sensations of the muscle sense and use them for the adjustment of movements. In cerebellar ataxia, therefore, he believes we have a disturbance of motion in such parts of the body in which the movement is not or cannot be controlled any more by the cerebral step of consciousness.

Photography of the Eyeground. Dr. Walter Thorner¹ has so modified his well-known stationary ophthalmoscope that he can use it for photographing the fundus of the eye without being annoyed by the corneal reflex. At the October meeting of the Berlin Physiological Society last year he showed two excellent photographs of the eyeground, but they were only those of cats. With human beings the apparatus did not give quite satisfactory results, because the light reflex from the

human eye is too weak to give pictures with the present form of the instrument. The fundus of the cat reflects about fifty times more light than that of man. The enlargement was about 7.5.

A Model to Explain the Mechanism of Accommodation. The model devised by F.

Schenk² represents a cross-section through the anterior part of the human eye (Fig. 46). The section through the cornea and the neighboring parts of the sclera, *S C S* in the accompanying figure, is formed of iron rods; the section of the lens capsule, *K K*, is represented by two curved steel springs which are fastened by two ribbons. These latter are attached to the iron rod and contain rubber in the part near the lens. This rubber is stretched and exerts a traction upon the lens capsule whereby the latter is flattened. Thus, the traction which the chorioid and suspensory ligament exert upon the lens according to the



theory of Helmholtz has been imitated. The ciliary muscle, *m m*, is represented by two muscle preparations, the double semimembranous gracilis preparation of Fick. The muscles are stretched between the corneal margin and the rubber. The two ends of the two wires from the secondary coil of the inductorium are placed on the upper end of the upper and lower end of the lower muscle preparation. Between these preparations the current is closed by the iron rod repre-

¹ Archiv f. Physiologie, 1903, Heft 1 and 2. S. 192.

² Archiv f. d. ges. Physiologie, 1902, Band xc., S. 231.

senting the cornea. If the muscles are tetanized they pull on the rubber. Thus the tension is taken from the lens, its curvature increases, it sinks down, and trembles.

The model is made by M. Rinck, in Marburg, and costs about four dollars.

Vision through Veils. When investigating the kind and amount of the visual disturbances on looking through veils C. Ladd-Franklin and Guttman¹ found that veils and veil-like wire nets affected the vision very differently according to the position of the veil with regard to the eye and the object looked at. The veil disturbs vision very little when close to the eye, and also little when nine to thirty feet from the eye; but when it stands between these distances, and especially when between one and three feet from the eye, the visual disturbance is quite considerable and may reduce vision to one-half or even to one-fifth. As causes for this reduction they mention especially the covering of the outlines of the object by threads of the veil, their obscuration by the diffusion images of these threads, and complicated disturbances by hindering the attention and the exactness of the observation.

About the Adaptation of the Retina. Piper² says the image of a luminous quadratic surface was thrown by a lens on a disk of porcelain and formed the light stimulus for the observing eye. Its brightness could be changed by means of an iris diaphragm in front of the objective and by a darkening of the luminous surface. The results of the experiments were the following:

The experience of Aubert (1865) was confirmed, namely, that the sensibility of the eye to light increases very rapidly in the first ten minutes after the entrance of the dark room, and from that time more slowly. After about forty minutes the maximum of the adaptation is reached. The amount of the increase in the sensibility, the breadth of the adaptation, is much greater than found by Aubert, for the adapted eye is able to perceive the $\frac{1}{8000}$ part of that light intensity which formed the threshold for the eye well adapted to light. There is no difference between monocular and binocular adaptation. Santonin poisoning, even if carried to the point of distinct yellow vision and marked general symptoms, had no appreciable influence on the process of adaptation. If the eye after one hour's adaptation in the dark has reached the lowest threshold and is then acted upon by such dim light which just lies above the foveal threshold, one finds on a renewed determination of the threshold value an increase in the sensibility such that now about two-thirds of the former light intensity is perceived. This increased sensibility is lost again after a few minutes' stay in the absolutely dark room.

¹ Archiv f. Physiologie, 1902, Supplementary Band.

² Ibid., 448.

Theories of Color Perception. Dr. Mary Whiton Calkins¹ gives no experiments of her own, but critically reviews all the existing theories of color perception. She believes that the psychical analysis of color perception forces us to accept four primary colors—red, green, yellow, and blue—and that the colorless light perception must be accepted as a primary and not as mixed sensation. By this the Young-Helmholtz theory is excluded *a priori*. It must not be forgotten, however, that the Young-Helmholtz theory has been modified by Koenig and others, who attribute the simple light perception to the rods, and it further must be remarked that the assumption of four primary colors—red, green, yellow, and blue—instead of three—red, green, blue—is simply based on a personal perception and conviction which ought not to be allowed to decide the question alone, in view of the fact that the trichromatic system in its later development by Koenig and others gives a very good account of the phenomena by only three primary perceptions. Hering's theory the author rejects on account of the fact that red and green do not give rise to a colorless light perception. Her final opinion she sums up thus: "The fact that the rods and cones primarily are quite equal structures, and that the cones have developed later, makes it very probable that a chemical process which takes place in the rods and cones in the same manner produces a colorless light perception, and, further, that different phases of this chemical process in the cones cause the perception of colors." These are the essential points in the theory of Mrs. Ladd-Franklin, which to her possesses the greatest biological probability. It may be added that these are not very different from the modified Young-Helmholtz theory.

The Sensations of the Skin. Dr. Z. Oppenheimer² confines himself to the tactile sensations of the skin. He reviews the anatomy of the terminations of the cutaneous sensory nerves and believes that the touch corpuscles of Merkel are elastic. Small mechanical forces set their capsule into vibrations, which are communicated to the tactile disks, the end organ of the nerve. A simple touch may produce such slight vibrations, but as a longer pressure causes a deformation of the apparatus he believes that the touch corpuscles of Merkel serve only for the perception of a light momentary touch. If the touch is a prolonged one the Pacini's corpuscles are called into function, because from their anatomical construction (their many capsules) it takes a longer time until the equilibrium, disturbed by the touching forces, is re-established again. Finally, he regards the end bulbs and touch corpuscles of Wagner as coils of the nerve fibrils, and believes them to be well adapted to measure the degree of solidity and the smoothness and roughness of the objects touched.

¹ Archiv f. Physiologie, 1902, Supplementary Band, S. 244.

² Ibid., S. 215.

HYGIENE.

By CHARLES HARRINGTON, M.D.

AIR.

Influence of Fog. The influence of fog on morbidity and mortality rates is shown by Sir James Crichton-Browne,¹ who says that one of the worst fogs on record occurred in London between early in November, 1879, and the following February. In the six weeks ending February 21st the deaths numbered 1730, 1900, 2200, 2376, 2495, and 2016. During the first three weeks of 1880, when London was largely clear of fog, the death-rate fell 40 per cent. below the average; but toward the end of January, when the fog again asserted itself, the deaths rose immediately to 43 per cent. above the average. Bronchitis, pneumonia, pleurisy, and other lung diseases and whooping-cough rose to an extraordinary degree, the death-rate from bronchitis rising to 331 per cent. and that from whooping-cough to 231 per cent. above the average. Again, he states that at Christmas, 1891, a fog visited London, which persisted for nearly one hundred hours. The number of deaths for the fortnight ending January 2d would have been, according to "estimation," 3728—that is to say, this number would have been about normal—but the actual number returned was 5170, or 1442 above the normal, mainly due to lung diseases or zymotic diseases, such as measles, in which lung complications are common.

WATER.

Purification of Water in the Field. During the late war in South Africa there was an appalling loss of life from water-borne diseases, especially typhoid fever, in consequence of which Nesfield,² of the Indian Medical Service, has turned his attention to the methods in vogue for sterilizing water in the field. The best and simplest way, that of boiling, cannot always be followed, because it is often difficult to procure fuel; then it takes time to cool the water, and soldiers will not drink it when warm, but will prefer the unboiled water. Filters

¹ Journal of the Sanitary Institute, October, 1902, p. 217.

² Public Health, July, 1903, p. 601.

need constant care and attention ; they frequently get blocked or cracked, and are not always to be relied upon ; hence some process is needed by which water may be made sterile quickly. He considers the various requirements of a chemical method of purification, which are : certainty of effect, the imparting of no taste to the water, absence of any noxious chemical substances in the water, and suitability for foreign travel ; that is to say, the agents employed must be easily portable and must not deteriorate by keeping. Chlorine gas suggested itself as an agent which might be satisfactory on all four points, and an extensive series of experiments gave repeated proof that 0.125 gramme of chlorine per litre of water infected with twenty-four-hour-old, forty-eight-hour-old, and sixty-four-hour-old broth cultures of *B. typhosus*, *B. coli*, and Shiga's dysentery bacillus was sufficient to produce sterility in five minutes, and in no case was there a failure. The water can be freed from chlorine with sodium sulphite, the resultant compounds being sodium sulphate and hydrochloric acid, which latter is neutralized at once by the alkali present in commercial sodium sulphite. One hundred grammes of chlorine will sterilize 176 gallons of water, and will require 177.46 grammes of sodium sulphite for neutralization. The gas is portable in two ways : it can be liquefied and stored in lead-lined iron vessels having a jet with a very fine capillary canal, and fitted with a tap or a screw cap. The tap is turned on and the cylinder placed in the amount of water needed. The gas bubbles out slowly, and in ten to fifteen minutes the water is absolutely safe, and needs only to be rendered tasteless by the addition of sodium sulphite, which may be made into a cake or tablet. One hundred grammes of liquid chlorine occupies 74.1 c.c. of space. If it is required to sterilize smaller quantities at a time (for example, that in a water bottle), tablets which evolve nascent chlorine can be used. These may be made with one and one-half grains of bleaching-powder mixed thoroughly with one-half a grain of sodium bicarbonate. One minute is sufficient to sterilize a pint of water, though it is best, out of abundant caution, to allow ten minutes. The addition of a quarter of a grain of sodium sulphite removes the chlorine and consequent bad taste. The bicarbonate is added for the purpose of keeping the tablet dry, and also because its carbon dioxide assists in the reaction. The tablet remains apparently unaltered in size at the bottom of the vessel, the water keeping perfectly clear. He recommends sodium sulphite tablets made by compressing the dry salt moistened with gum-arabic water and covered with a film of gelatin that takes just ten minutes to begin to dissolve. This is affixed to the chlorinating tablet, which thus has ten minutes' start when the two are introduced into the water ; so in fifteen minutes or less the water is sterile and tasteless. Nesfield is satisfied

that all the conditions laid down are met, and that the process is applicable (a) for soldiers or travellers in countries where they must depend for their water supply on any stream, well, or hole which they may pass; (b) for rendering water aseptic for surgical purposes, and thus giving a better chance of success in grave operations undertaken in emergency; (c) for washing oysters, watercress, and similar food-stuff liable to sewage contamination; and (d) for domestic use in times of epidemic of cholera, typhoid fever, etc.

Action of Water on Lead. The statement is often made that water containing peat acids has a corrosive action on lead pipe. According to Dr. Houston, the ratio between the degree of acidity and the corrosive power is not the same for all peaty waters, for some have unusual power in this direction, irrespective of the degree of acidity. Some spring waters mixed with peaty waters may so influence the reaction of the latter that the mixture will have no action on lead. In case of a water supply which is either normally acid or likely to become so, it is recommended that neutralization be carried out by filtration through sand, the surface of the sand being coated with lime to act as a neutralizing agent, or the sand being underlaid with limestone for the accomplishment of the same result. The neutral filtrated water may then be given a trace of sodium carbonate.

Ruzicka¹ has conducted a series of experiments with distilled water and with solutions of salts of calcium, magnesium, potassium, sodium, and ammonium (sulphates, chlorides, carbonates, and nitrates) on clean lead pipe under various conditions, as contact with air, exclusion of air, renewal of the solutions, mixing of solutions, etc., and has determined the amount of lead taken up in each case. Water containing carbon dioxide and soluble organic matter from grass, peat, radish leaves, and fish flesh were also tried. His conclusions were: 1. The influence of inorganic salts in solution is independent of the nature of the base, but is due wholly to the combined acids. Nitrates in solution cause almost as much corrosion as does distilled water, but chlorides, sulphates, and carbonates exert a restraining action. 2. With combined solutions of salts the order of the restraining influence of the several salts is, from least to greatest, nitrates, chlorides, sulphates, carbonates. Carbonates always diminish the rate of corrosion by the other three; sulphates, that by chlorides and nitrates; chlorides, that by sulphates and nitrates; and nitrates always increase the action of the other three. 3. If lead comes continuously in contact with fresh portions of a carbonate solution, the amount of lead given up, small in any event, diminishes progressively. 4. A relatively small amount of carbonate can overcome

¹ Archiv f. Hygiene, xli. p. 23.

the influence of nitrate (6 carbonate to 10 nitrate), but when it falls at all below the necessary amount (to 5 parts, for instance) the action increases at once. 5. Free carbon dioxide, contrary to general belief, causes diminished action with both distilled water and the salt solutions. 6. The organic matters of peat increase corrosion; those of the other substances employed inhibit it. 7. Carbonates, carbon dioxide, and extracts of grass and of radish leaves exert greater inhibitive influence than the other substances used. Under all conditions, access of air results in increased corrosion.

Significance of Nitrites in Water. Experiments conducted by Dienert¹ led to the following conclusions: 1. Nitrites may be found in the subsoil in the absence of contamination. 2. Pollution is not always followed by the formation of nitrites. 3. It is necessary to take certain precautions in testing for nitrites, for, if during transportation the temperature is sufficiently high, nitrites may be found, although none was present when the sample was taken. The test should be made at the time and place of taking. 4. Judgment of a water should not be based upon the presence of nitrites.

That undue significance should not be accorded the presence of nitrites is held also by Rideal,² who says that they may be derived from four sources: (1) the soil; (2) the air; (3) oxidation of ammonia; (4) the reduction of nitrates. The first two are consistent with the absence of organic matter and the presence of no bacteria, or of only the innocuous, atmospheric kind. Compounds of ammonia, nitrous and nitric acid are known to be very stable in dilute solutions devoid of the organisms producing change; therefore, any of them may exist in organically pure water. It is the transformation from one to the other that is a suspicious sign. The third source of nitrites indicates really a considerable improvement in the water, because nitrites in this dilution are quite innocuous, and are susceptible of still further purification by double decomposition with ammonia and with the amido-compounds, which constitute a large portion of the molecule of albuminous substances. To show how rapid this change may be, the micrococcus isolated by P. F. Richter produced in twenty minutes a nitrite reaction in fresh urine. The organism named by Winogradsky "nitrosomonas" oxidizes ammonia to nitrite without requiring for its nutriment any other carbon and nitrogen than it derives from air and from carbonates; consequently, it can form nitrites in water organically pure. The fourth source has been elaborately studied. Nitrites can be formed and can persist in solutions almost absolutely free from

¹ *Révue d'Hygiène*, April 20, 1903.

² *Journal of State Medicine*, June, 1902, p. 333.

organic matter, as in the case of the common organism "nitrobacter." It is true that most bacteria which transform nitrates to nitrites require the presence of fermentable carbonaceous substances, and that this change usually indicates organic impurity. But there are many non-pathogenic organisms in the air or soil that can grow in the purest waters and generate minute traces of nitrite. For example, P. Frankland gives the following: *B. ramosus*, *violaceus*, *vermicularis*, *liquidus*, *cereus*, *pestifer*, *plicatus*, *prodigiosus*, *chlorinus*, *citreus*. Stocklasa adds *subtilis* and *megatherium*, and Burri and Stutzer, *B. denitrificans*. On the other hand, a large number of organisms, some of them pathogenic, reduce nitrite to gaseous nitrogen or to nitrous oxide, acting generally by symbiosis, the intermediate production of nitrous acid not being detectable, probably because it is destroyed as fast as it is formed. The pathogenic *B. pyocyaneus* is one of them. The following are possible conditions: 1. There may be no nitrite, yet pathogenic and other organisms may be present. 2. There may be nitrite with no pathogenic organisms present. In the presence of certain bacteria, the majority of which are harmless, the circumstances may be (a) high free oxygen with nitrite; (b) low free oxygen without nitrite, but with nitrogen and carbon dioxide. If a water is highly aerated and contains nitrites, it is evidence that some bacillus forming nitrite from ammonia is present, and that such forms as *B. coli* and *B. typhosus* are absent; and in this case the nitrite would be actually a good sign. In drinking waters the presence of very small quantities of nitrites may have no significance, and, therefore, reliance on this test alone is objectionable.

Sewage Bacteria in Drinking Water. Especial attention is called by Horton¹ to the significance of the presence of the colon bacillus in water from springs and drilled wells. Samples were taken from twenty-five wells varying from 16 to 243 feet in depth, most of them from 25 to 80 feet, and from twelve springs. Some of the latter were open to surface pollution, but the wells were not exposed to this danger. The number of bacteria found in the well waters ranged from 16 to 900,000 per c.c., and in the spring waters from 90 to 400,000 per c.c. Some of the chemical analyses showed sewage pollution, some gave slight evidence, and some none at all. In connection with twenty-five of the thirty-seven waters there was a history of typhoid fever, the number of cases per well varying from one to sixteen, and per spring from one to seventeen. From his investigations the following conclusions were drawn: 1. We believe the organism found in these waters from springs and wells was *B. coli*. 2. The presence of *B. coli* in spring water should be looked upon with suspicion unless there is apparent oppor-

¹ Journal of Hygiene, April, 1903, p. 155.

tunity for pollution by the lower animals. 3. The presence of *B. coli* in water from a drilled well should generally condemn that water for domestic use. 4. The fact that a water is derived from a drilled well should not be taken as an absolute guarantee that it is a potable water. 5. Both chemical and bacterial examination of a water are desirable, but the bacterial will sometimes prove the more delicate indicator of direct pollution, which is the more dangerous pollution.

Concerning the alleged ubiquity of the colon bacillus and the importance of streptococci as indicators of the presence of sewage matters in drinking water, a valuable and instructive paper is contributed by C. E. A. Winslow and Miss M. P. Hunnewell,¹ who made bacteriological examinations of 157 samples of water from apparently unpolluted sources and of 50 from obviously polluted sources, paying special attention to what appears to be the most important point in connection with the sanitary significance of the results of such examinations, namely, the approximate number of the organisms found.

Single cubic centimetre examinations of the 157 samples from apparently unpolluted sources revealed the colon bacillus but five times, the paracolon organisms also five times, and streptococci three times; but when 100 c.c. were employed the same organisms were detected, respectively, eleven, five, and ten times. Single cubic centimetre examinations of fifty samples from obviously polluted sources showed the colon bacillus in eighteen, the paracolon group in six, and streptococci in twenty-five; and 100 c.c. samples yielded but four positive results as to the colon bacillus and twenty-two as to streptococci.

An interesting localized outbreak of what appeared to be typhoid fever traced to contaminated water is reported by Sion and Nagel.² Six individuals, members of one household, were seized with symptoms which in each case were not to be differentiated from those of typhoid fever. One of the victims died with a complication of meningitis, which appeared several days before death. The post-mortem appearances were not those of typhoid fever, but suggested a streptococcus or pneumococcus infection. Cultures from blood and brain, liver, spleen, heart, and other parts yielded a small, very motile bacillus, which did not stain by Gram. Cultures made from the blood of four of the other patients yielded the same bacillus, which differed from the organism of typhoid fever in that it formed no gas with glucose media and did not agglutinate with typhoid serum. It differed from the colon bacillus in that it formed no gas with lactose, and also in other particulars. The cause of the outbreak was traced to a contaminated well, the water of

¹ Journal of Medical Research, December, 1902.

² Centralblatt f. Bakteriologie, etc., 1902, xxxii. pp. 481, 581, and 679.

which was used in the household for drinking and other purposes. The well water yielded an abundance of the same kind of bacillus that was isolated from the blood of the living and from the tissues of the dead.

Ice and Disease. The effects of lower temperature on the typhoid bacillus have been elaborately studied by Sedgwick and Winslow,¹ the object being to determine the possibility of contracting typhoid fever from infected ice. They found that about half of the typhoid bacilli in given specimens of water were killed during the first half-hour of freezing, and that less than 1 per cent. survived the freezing fourteen days. Even when water is not frozen, but is maintained just above the freezing point, the typhoid bacilli are short lived. Ice was found to contain only about 10 per cent. of the number of bacteria contained in the water from which it froze, the exclusion being probably due to physical forces (crystallization) rather than to any bactericidal action of the cold. From their own results and from those of others they conclude that the risk of contracting typhoid fever through the use of natural ice is exceedingly small; but with artificial ice the risk is greater if the water from which it is made is impure, because artificial ice is ordinarily not stored, but is made from day to day and marketed at once.

[NOTE.—Recent experience at Ogdensburg, N. Y., has proved conclusively that infected ice may transmit typhoid fever after nine months' storage.]

The fact that ice always contains a smaller number of germs than the water from which it is made has been the subject of an inquiry by Abba.² This has hitherto been attributed to the germicidal action of low temperature; but Abba found, working with artificial ice made from water inoculated with bacteria and colored with chemical substances, that this self-purification is to be attributed to the exclusion of all the substances which are foreign to the chemical constitution of water, and he arrived at the following conclusions: 1. The biological self-purification of ice depends on the same process as that which brings about chemical self-purification. 2. Just as water in freezing exerts itself to exclude all the salts which it contains in solution and everything which is foreign to its molecule, so, also, it makes the attempt to free itself of all organic substances, including bacteria, which may be present, and it endeavors to approximate, as far as possible, the character of distilled water. 3. In the preparation of artificial ice it is advisable, when it is not possible to use distilled or boiled water, to remove the water in the centre of the block before the complete solidification of the ice, since that contains all of the organic and inorganic

¹ Memoirs of the American Academy of Arts and Sciences, vol. xii., No. 5, p. 472.

² Revista d'Igiene e Sanita publica, 1903.

impurities. 4. In using ice for drinking water, and particularly in the treatment of the sick, crystalline ice should always be preferred, for this either contains no bacteria at all or at least a very much smaller number than that which we know as snow ice.

MILK.

Composition. The milk of about six hundred cows, one-third of which were pure-bred Jerseys and the rest "grades," was examined from time to time by Sherman,¹ who reports that monthly analyses extending over two years showed the percentage of protein to vary with the season, being higher in autumn and winter than in spring and summer. The fat varies likewise, but the milk-sugar remains nearly constant the year round. In general, richness in fat is accompanied by richness in protein. In practically all of the samples the relation between protein and ash was very nearly that found by Richmond and expressed by the formula: $\text{Ash} = 0.36 + 0.11 \text{ protein}$. Sherman's modification of the formula according to results would make it: $\text{Ash} = 0.38 + 0.10 \text{ protein}$. The higher percentage of fat in autumn and winter is shown also by Richmond,² who examined 13,936 specimens during 1901 in England, and found the lowest fats in May and June and the highest in November and December. The average composition of the whole number was: fat, 3.72; solids not fat, 8.91; total solids, 12.63.

Milk Powder. Milk powder, to which reference was made in this publication a year ago, bids fair to become an article of great commercial and nutritive importance. Since the milk powder made from pure milk does not keep so well as that made from skimmed milk, that made in future according to the Ekenburg patents will be made wholly from skimmed milk. The maximum cost of production is about one cent per gallon of skimmed milk handled. The skimmed milk which comes from the improved milk separators contains the merest trace of fat, and in many creameries is got rid of by discharge into the sewers on account of its small value. But it can be converted into this valuable food product, which consists of proteids, 36 per cent.; sugar of milk, 49 per cent.; fat, 1 per cent.; ash, 7.5 per cent.; and moisture, 6.5 per cent. It is estimated that in Sweden the skimmed milk produced at the various creameries amounted to about one and one-third billion pounds, which would have yielded about one hundred and thirty-five thousand pounds of milk powder. From a nutritive standpoint the proteid value of this product is greater than that of a somewhat larger amount of

¹ Journal of the American Chemical Society, February, 1903, p. 132.

² The Analyst, 1902, p. 240.

boneless meat, and three times as much white of egg. But the actual food value is still greater, on account of the very large percentage of carbohydrate in the form of milk-sugar. In Sweden the powder can be sold, at a good profit, for about eight and one-half cents a pound. The powder is used instead of milk in making bread, puddings, sauces, cakes, confectionery, etc.

Milk and Outbreak of Disease. *Scarlet Fever.* Lincoln, England, has recently passed through an outbreak of *scarlet fever* which will probably go into the literature of hygiene as another instance of the so-called "Hendon disease." The original outbreak, it will be recalled, occurred in Marylebone, in 1885, and was investigated by Klein, who traced it back to cows in a supposedly infected dairy. In the outbreak in Lincoln all of the cases have been traced by the Medical Officer of Health to one dairy, at which the cows were found to be suffering from a vesicular eruption on the teats and other parts. Most of the patients were seized on the same day, the symptoms being sore-throat, vomiting, and sometimes diarrhoea, and in many cases a scarlatiniform rash on the third day, with desquamation about a week later. Not one of the patients, who numbered forty, was seriously sick. In one household no less than fourteen persons were seized. The same community suffered from a corresponding outbreak in 1902, about a year before. In this more than one hundred persons were affected by the disorder, which appears to have been more severe in its nature, and resulted in four fatalities. As in the present instance, all of the persons seized had drunk milk from one dairy, but not from the same dairy as is now implicated.

A more interesting outbreak of undoubted scarlet fever is that reported by Ekholm.¹ The disease broke out in six families who were supplied with milk from a farm where lived a milkmaid who shortly before had been treated for a phlegmonous angina.

Diphtheria. A supposed case of connection of diphtheria with the milk supply has recently been reported by Dr. A. K. Chalmers, Medical Officer of Health, of Glasgow. Five cases of the disease occurred among those who drank milk from a farm carried on by a farmer whose throat was found to contain the bacilli of diphtheria in large numbers. At no time had he had any definite symptoms, and he had not considered himself seriously ill. During his sickness he had occasionally done the milking, which may account for the fact that the milk was infected only in part, and hence the number of cases was no larger.

Aphthous Fever. During the prevalence of the foot-and-mouth disease in the New England States during the present year, Dr. E. F.

¹ Zeitschrift f. klin. Medicin, xlix., Nos. 1-4.

Brush¹ wrote to Dr. Salmon, Chief of the Bureau of Animal Industry at Washington, asking where he could find cases of human aphthæ acquired from the milk of animals suffering with the disease, and was informed that, while it was improbable that such cases could be found, Concord, Massachusetts, would be a good field for research. Accordingly he went to Concord, where 327 cattle had been killed because of the disease; and among all the farmers who owned these animals only one was found who peddled milk in the village, and his was the first herd to contract the disease. Among his customers were four persons who were ill, and these were an old gentleman and his wife, who suffered with slight fever and nausea, their son, who had mild aphthæ and herpetic eruption, and a middle-aged woman with a very sore mouth with the characteristic vesicular eruption of aphthæ. Investigation showed that the customers had been supplied with the mixed milk of some forty-odd cows, of which only one was sick. He found in Lawrence a family with five children, all of whom had aphthæ after drinking milk supplied by a dealer whose cows were condemned shortly afterward. Four of the children had sore mouths, without being very sick; but the fifth one was very sick, with vomiting, some diarrhœa, and fever. The tongue was very much swollen and was covered with blisters, as were the lips. After four days of sickness this child began to have severe convulsions, several daily. The milk was stopped, and recovery followed in every case. Another case of aphthous fever in an infant, aged thirteen months, is reported by Josias,² who traced it to a dairy where the disease existed among the cows.

Scorbutus. It is known that fresh milk possesses antiscorbutic properties, and that these properties are destroyed by heating, but we do not know to what these properties are due, although we can surmise that they are due, in part, at least, to the presence of citric acid in the form of calcium citrate as a normal constituent. This compound is more soluble in the cold, and under the influence of a boiling temperature is converted into a compound which is largely precipitated, and is only dissolved in part on cooling. Cows' milk contains much more citric acid than does human milk, but it is evident from the very large number of cases of scorbutus occurring among children fed on sterilized milk that the excess does not always suffice, although it may account for the fact that most infants so fed do not develop the disorder.

Among the more recent articles on the connection existing between sterilized milk and scorbutus is that of Netter,³ who was one of the

¹ Journal of the American Medical Association, June 20, 1903.

² Gazette hebdomadaire de médecine et de chirurgie, June 1, 1902.

³ Revue mensuelle des maladies de l'enfance, December, 1902, p. 543.

first, and who claims, indeed, to have been the very first, to call attention to it. He reports twenty-three cases of the disease, in nine of which the infants were fed on sterilized milk. He believes that citric acid is but one of a number of antiscorbutic influences present in milk. In the rare cases of scurvy occurring in breast-fed children he believes that the mother's physical condition is responsible for the loss of the protective influence.

Cronheim and Müller¹ report the results of experiments with *sterilized milk*. Two strong, healthy infants free from evidence of rachitis were given sterilized milk for awhile, and then were fed on raw, unsterilized milk. It was found that they failed to absorb lime salts from sterilized milk, and hence the use of these should not be persisted in for any length of time, since otherwise the growth of bone may be affected. Sill² maintains that, when properly prepared, cows' milk is the best substitute for mother's milk, but that it is not improved by the process of sterilization or even of pasteurization, for the use of milk so treated undoubtedly leads in many cases to rickets, scurvy, and kindred diseases. Instead of pasteurizing milk, he recommends that it be received in sterilized bottles, tightly sealed, and cooled immediately to 40° F. A temperature much above that of the body exerts an injurious influence on the albuminoid and mineral constituents. The process of sterilizing milk also destroys all of the ferments of the milk, which results, as has been shown by Moro,³ in interfering with the gain in weight of milk-fed children. Neumann⁴ believes that in the process of heating milk, substances like hydrogen sulphide are produced and may be concerned in the production of infantile scurvy. He speaks of four cases of the disease in which there was hemorrhage from the kidneys, in three of which the condition disappeared on proper feeding. The fourth patient continued to receive pasteurized milk, and finally died. He speaks, also, of two boys who developed nephritis after a steady diet of milk that had been heated to a high degree. In 1901 and 1902 he collected in Berlin a large number of cases of scurvy in families which used pasteurized milk from a first-class dairy.

The differences between the ferments found in the milk of human beings and in that of animals are detailed by Nobécourt and Merklen,⁵ who find that all of them are found in human milk and in the milk of dogs and asses, but amylase and the salol-splitting ferment are not found in the milk of cows and goats. On account of the difficulties in

¹ Jahrbuch f. Kinderheilkunde, January, 1903, vol. lvii.

² Medical Record, December 27, 1902.

³ Jahrbuch f. Kinderheilkunde, October, 1902, vol. lvii.

⁴ Deutsche med. Wochenschrift, August 28, 1902.

⁵ La presse médicale, December, 1902.

the line of experimentation with the ferments of milk, there is at present but little real knowledge concerning their value.

The Bacteriological Condition of Milk after Treatment with Borax. The behavior of milk after treatment with borax, especially with reference to souring, has been studied by Richter,¹ who found that slight variations in the time of coagulation were due to differences in the freshness of the milk before treatment and to differences in the temperature of the place of storage, which varied from 15° to 25° C. (59° to 77° F.). He succeeded in preventing coagulation permanently only after adding 4 per cent. of borax, but this amount of the drug caused such a disagreeable taste as to make the milk useless. His conclusions are as follows: 1. The development of bacteria seems to be furthered after a very short time, and this is due, perhaps, to the fact that the addition of borax facilitates the dissemination of colonies of bacteria. 2. The growth of *oidium lactis* is hindered considerably by borax. 3. The same is true of *B. acidi lactici* (Hueppe) and *B. acidi lactici* (Günther). 4. The liquefying and other bacteria of putrefaction are not hindered in their growth by borax, but after a time they perish spontaneously. 5. In the first few days Hueppe's lactic acid bacteria are present in greatest number, especially in untreated milk, but they are succeeded later on by those of Günther. The greatest number of colonies occurs on the second and third days. From the sixth to the eleventh day there is a considerable diminution in the number of colonies in pure milk as well as in boraxed milk. 7. The surviving cocci were almost exclusively air cocci, chiefly *micrococcus candicans* (Flügge).

ALCOHOLIC DRINKS.

Some time ago the French Government requested the Académie de Médecine to investigate the subject of liqueurs and to submit two lists, one, of those which are dangerous, and the other, of those the least objectionable. The committee appointed consisted of Laborde, chairman, and Messieurs Brouardel, Lancereaux, Cornil, Magnan, Pouchet, Motet, and Joffroy. They reported their conclusions at a session of the Académie on March 10, 1903, and submitted a list of the most dangerous volatile oils which enter into the composition of liqueurs, recommending that they should be absolutely prohibited because of their dangerous nature. This list included: oil of wormwood (absinthe), oil of rue, oil of gaultheria, oil of star anise, oil of hyssop, and oil of angostura. In a second list of objectionable oils, but not sufficiently objectionable to warrant absolute prohibition, are mentioned the vola-

¹ Archiv f. Hygiene, xliii. p. 151.

tile oils of clove, mace, nutmeg, peppermint, and a number of others. The Académie voted that all volatile oils, natural and artificial, and the various extractives which are incorporated with alcohol or wine, make drinks that are injurious and dangerous, the danger being due to the oils and alcohol. It calls particular attention to the danger of drinking them before meals, when their absorption is most rapid and their poisonous properties most active. It was also voted to recommend and to urge that measures be taken to diminish the sale of such drinks.

DISINFECTION.

Action of Daylight on Bacteria in Dust. Having demonstrated that typhoid bacilli and *B. prodigiosus* sprayed in the finest droplets die within twenty-four hours if exposed to light and air, and supposing that different species may show different resistance to these influences, Kirstein¹ made a number of additional experiments which showed his supposition to have been correct. He found that the germs of diphtheria handled in the same way and exposed to diffused light were active even after forty-six hours, and died only after fifty-five hours. With dim light in a cellar they retained their vitality one hundred and thirty hours, and dried on linen rags and silk threads they lived one hundred and fifteen and one hundred and forty days. The tubercle bacillus in sputum cannot be sprayed until the material has been treated with salt solution and shaken with sand. Animal experimentation showed that with ordinary daylight the infective properties of sputum are not diminished after four days, but after six days they disappear. In a half-dark cellar the organisms lived even after twenty-two days. Dried on linen rags and on silk threads they were living after thirty and forty-five days, and in dried balls of sputum they were alive even after three and one-half months. Staphylococci sprayed in the finest drops survived ten to sixteen days in diffused daylight and thirty-six to forty days in a cellar; on linen rags and silk threads they remained virulent three and one-half and five and one-half months. Streptococci behaved pretty much in the same way. Anthrax spores in the finest form of spray were killed after ten weeks of exposure to diffused daylight, but if not so exposed they retained their virulence.

The whole work shows how important it is to insist upon thorough disinfection of dwellings; that is, we recognize that the life of tubercle bacilli and of pus cocci is prolonged with deficient lighting.

In another series of experiments he dealt with the second source of air infection with the finest dry dust particles. He dried *prodigiosus*

¹ Zeitschrift f. Hygiene und Infektionskrankheiten, xxxix. p. 93.

cultures, rubbed them fine, and converted them to dust, and found that they were still active after eight to twelve days' exposure to diffused light; that is to say, materially longer than in droplets of the same size. The reason for this lies in the balling together of the individual germs, and this can be demonstrated microscopically. The same dust kept in a cellar retained its vitality twenty-five days, and in coarser form seventy days. When the expectorations of bronchitis were mixed with prodigious cultures, and then dried and converted to dust, the prodigious germs lived four days; pus cocci cultures dried and converted to dust lived for twenty-two days, but not after twenty-eight days.

From the above it appears that germs attached to dust particles have a materially longer life than germs in equally heavy droplets, and the length of life of bacteria is dependent upon the thickness of the material in which they find themselves and upon the protection which they derive therefrom against light and drying.

Sulphur Dioxide. Calmette¹ still believes in the efficacy of sulphurous acid gas as a disinfectant. He finds it easy to measure the extent to which the gas penetrates, by means of a very simple chemical test, depending upon the change of color of dry, fine sand colored blue with litmus. The sand is placed in glass tubes 5 to 10 mm. in diameter and a metre in length, stopped with a pledget of cotton-wool. These tubes are placed horizontally at different heights in the room operated upon. The greater the concentration of the gas or the greater the length of time of exposure, the more deeply the gas will penetrate. The sand is colored red as far as the gas penetrates. He has determined by experiment that the death of the typhoid bacillus coincides with a reddening of 25 cm. of the sand confined in the tube, but that the bacillus of diphtheria is considerably more hardy, its death point being equal to 40 cm.

In every case of practical disinfection he asserts that a bacterial test of its efficiency should be made. For example, if a room is to be disinfected after a case of diphtheria, dried cultures of *B. diphtheriæ* should be placed in the room in small glass tubes 10 mm. in diameter and 10 cm. in length, open at both ends and plugged with cotton-wool. After disinfection has been carried out, these can be planted and examined. It is better to mix the cultures with serum, so that the bacteria may be protected by the albumin which dries on the surface of the paper or cloth on which they are placed.

For determining the efficacy of formaldehyde disinfection he mixes a quantity of blood serum of the horse with solution of fuchsin rubine,

¹ Bulletin de l'Académie de Médecine, 1903, xlix., No. 18.

and dries it at a temperature of 40° C. This yields bright-red scales, very soluble in water; but if they are subjected to the action of formaldehyde gas, the color is fixed and becomes insoluble in water. Calmette fills tubes with dry sand or cotton-wool and places at intervals some of the scales or disks of filter paper soaked in the fuchsin serum and dried. After the process of disinfection is completed these may be moistened in water, when those which have been reached by the formaldehyde vapor will not yield their coloring matter to the water, while those which have not been reached will do so. The biological test of the efficacy of formaldehyde disinfection can be carried out in the same way as for that of sulphurous acid.

Dry Heat. Although dry hot air is so uncertain in its action as to be unsuited to practical disinfection, Schumburg¹ shows that at 100° C. (212° F.) it will kill the most resistant non-sporing bacteria in and on clothing and other objects within an hour, if it contains from 55 to 65 relative humidity. This degree of moisture can be attained by having a vessel of water in the space where the objects are treated. Since disinfection of clothing and other objects containing anthrax and tetanus spores is very seldom needed, and since, on the other hand, the bacteria most commonly the object of disinfection (those of typhoid fever, cholera, plague, influenza, diphtheria, tuberculosis, and probably measles and scarlet fever and the pus cocci) form no spores, disinfection with moist hot air will suffice in almost all cases. This method has this advantage over disinfection by steam: that articles of leather (gloves, books, riding breeches, etc.) may be exposed from six to eight hours without injury.

Steam. The effect of steam disinfection on clothing has been investigated by Mordberg,² who arrived at the following conclusions: Under the influence of steam at 104° to 111° C. (219.2° to 231.8° F.) for one hour the material is always increased in thickness, and still more so after being wetted in water and then boiled. The specific gravity of the material is lessened, and much more so on boiling, by reason of the solution of the coloring matter and of soluble materials with which the clothing is charged. The size of the interstitial spaces is increased. Steam at high temperatures causes all fabrics to shrink, but the shrinkage is less than when the material is wetted with water or boiled. Some fabrics undergo changes in color, especially those of light color, light gray materials taking on a yellowish-brown tint.

FORMALIN-STEAM. According to Kokubo,³ the addition of a relatively small amount of chemical disinfectants to streaming steam causes

¹ *Zeitschrift f. Hygiene und Infektionskrankheiten*, xli. p. 167.

² *Bolnitchnaja Gazeta Botkina*, December 25, 1902.

³ *Centralblatt f. Bakteriologie*, etc., Abth. I., vol. xxxii., No. 3, p. 314.

a very marked increase in its disinfectant power. He found that anthrax spores are killed in a minute by the addition of 0.10 per cent. of formalin, or of 3 per cent. of creosote, tricresol, or acetic acid. The very resistant potato bacilli, which ordinarily can withstand steam at 100° C. (212° F.) for two hours, was killed by formalin-steam in two minutes. His experiments have been repeated with certain modifications by Esmarch.¹ In the centre of a bundle made up of three woollen bedspreads, compactly folded and rolled one over another and tied with a cord, he placed a maximum-minimum thermometer and two specimens of anthrax spores. Another specimen of spores was placed between the innermost and middle blankets, and still another between the latter and the outer one. The anthrax spores were dried on silk threads, and in all the experiments performed were enclosed in capsules of filter paper. He employed also staphylococci dried on silk threads, and these were used in the same way. In the first experiment the blankets were exposed for thirty minutes to the steam, and the thermometer showed 103° C. (217.4° F.). Both of the outer specimens of spores were destroyed, but the innermost one was not. Then the experiment was repeated in exactly the same way, excepting that this time the water contained 1 per cent. of formalin. At the conclusion of the exposure the thermometer stood at 102° C. (215.6° F.), and the test objects were all destroyed. In the next experiment, which was conducted in a similar manner, but with the time of exposure cut down to fifteen minutes, the thermometer rose only to 65° C. (149° F.), but, nevertheless, the spores were destroyed. Thus, the effect of the formaldehyde-steam was greater than that observed when steam alone was employed for twice the length of time. The blankets had a slight odor of formaldehyde, but this disappeared very quickly.

He employed a small apparatus for further experimentation with articles which cannot withstand a temperature of 100° C. (212° F.) without being ruined or at least injured—articles such as leather, furs, skins, and brushes. This was provided with an apparatus for producing a partial vacuum. A mixture of air and of steam generated from water containing 1 per cent. of formalin destroyed anthrax spores in three minutes at a temperature of 70° C. (158° F.). When the temperature was raised to 86° C. everything was sterilized in two minutes. Since the lowest temperature which is capable of causing injury to leather goods lies between 75° C. and 80° C., it seems probable that chemical disinfection of these articles can be attained with no great expenditure of time. In order to determine whether the action of the combined vapor was merely superficial, spores in filter paper were

¹ Hygienische Rundschau, 1902, No. 19, p. 961.

wrapped six times in flannel, and then tested as before at a temperature of 80° C. Those in the innermost part of the bundle were not destroyed in five minutes, but were destroyed in ten minutes. When the temperature was only 70° C. (158° F.) they were not destroyed until after half an hour. *Staphylococcus aureus* behaved exactly the same way as anthrax spores. With a partial vacuum the results were more favorable, destruction being effected at 70° C. (158° F.) in five minutes, and at 60° C. (140° F.) after fifteen and twenty minutes. Both the staphylococci and the anthrax spores were destroyed. The addition of a greater amount of formalin had no apparent effect in increasing action in the absence of the partial vacuum, but with the partial vacuum the employment of 2 per cent. formalin caused the destruction of the spores in ten minutes at 60° C. Additional experiments were tried on a larger scale with an apparatus which had a chamber measuring 80 x 30 cm. In the first experiment a coat, in the pockets of which were packages containing anthrax spores and *staphylococcus aureus*, thermometers, kid gloves, and articles made of rubber and of skin, was tied up tightly with string and exposed. The temperature was kept at 70° C. (158° F.), and the exposure lasted forty-five minutes. All of the test bacteria were destroyed, but the articles were in no respect injured. The experiment was repeated, but the temperature was raised to 80° C. (176° F.), and the exposure cut down to fifteen minutes. As before, everything was sterile and nothing was injured. The maximum thermometer stood at 74° C. (165.2° F.). In two further experiments the formalin addition was reduced one-half—that is to say, to 1 per cent.—but the effect was less favorable in spite of a much longer exposure.

For positive disinfection with this apparatus one must avoid too close packing, which interferes with easy penetration of the gas. In a series of experiments with a special apparatus the flannel blankets were folded solidly two or three times and tied up. In the centre of the bundle were two specimens of anthrax spores, a maximum thermometer, and a bell thermometer set at 69° C. (156.2° F.). In each of the middle and outer blankets were placed an anthrax test object and a maximum thermometer. It was soon evident that by withdrawing the air the temperature of the interior of the blankets was very quickly affected, for the bell rang in the second blanket in from seven to twelve minutes, and in the innermost one after thirteen to fifteen minutes. But in spite of the rapid penetration of the steam, exposures of thirty and forty-five minutes were not sufficient to cause the death of the anthrax spores in every instance, even when the amount of formalin was increased to 4 per cent. The same results were obtained with horsehair packed solid into a bag.

Voges¹ believes that he has hit upon the best method of disinfecting passengers' baggage on quarantine vessels. He introduces the vapor of a mixture of 600 c.c. formalin and 2400 c.c. water into a chamber in which a partial vacuum is produced in the usual manner. Preliminary experiments with anthrax spores, staphylococcus aureus, and typhoid bacilli had yielded very favorable results, the test objects having been destroyed inside of half an hour, although enclosed in handkerchiefs. In the chamber which he constructed he found that every particle of moisture was rapidly absorbed and that the formaldehyde was everywhere diffused. The time required is about the same as that in steam disinfection, and the process is adapted to objects which cannot be treated with steam, such as furs, rubber and leather articles, and glued furniture.

Formaldehyde. Those who have insisted upon the non-toxic properties of formalin will be interested in the case, reported by Gerlach,² of a servant who, through mistake, swallowed an unknown quantity of the liquid. She became unconscious, and, although the stomach was washed out, she did not recover consciousness until the following day. At first there was retention of urine, and later albuminuria. The general symptoms were unconsciousness, rapid respiration and pulse, and anuria. Eventually she recovered. Another case is reported by Testi³ of a man who swallowed a mouthful of the commercial solution. The patient immediately experienced an intense burning sensation, followed by vomiting. Swallowing became almost impossible on account of the extreme pain in the pharynx, the base of the tongue, and upper part of the œsophagus. When seen by Testi the face was congested; the eyes were bloodshot, the buccal and pharyngeal mucous membrane and the fauces and tonsils were swollen and congested. The condition remained unchanged for several days, and during all this time the patient was able to swallow but a very small amount of liquid. Two large eschars were detached on the sixth day from the fauces and tonsils. Unlike the case reported before, this victim did not lose consciousness and did not suffer from anuria, nor were the respiration and circulation affected. This was due probably to the fact that immediate vomiting prevented the poison from being absorbed, the effects produced being wholly local.

Washing Soda. Attention is called by Simon⁴ to a substance in common domestic use which has valuable disinfectant properties, namely, washing soda. The various chemical compounds employed in the practice of disinfection have, with one exception, some drawback: they are

¹ Centralblatt f. Bakteriologie, etc., Abth. I., vol. xxxii., No. 4, p. 314.

² Münchener med. Wochenschrift, September 9, 1902.

³ Il Policlinico, December 20, 1902.

⁴ Zeitschrift f. Hygiene und Infektionskrankheiten, June 10, 1903, xliii. p. 348.

poisonous, or of unpleasant odor, or expensive. The exception is caustic lime, but this exerts a corrosive action on very many objects which may come to treatment. The increase in disinfectant power of chemical agents in solution, which comes from increase in temperature, suggested an investigation of the germicidal action of hot soda solution, which long has been used in every household as a cleaning agent owing to its property of saponifying grease and dissolving albuminous substances. In his experiments he avoided temperatures above 140° F., water at this temperature being so hot that only a person accustomed to handling hot water can hold the hand in it for more than a few seconds. The solutions used contained 2, 5, 10, and 20 per cent. of soda, and ranged from 72° to 140° F. in temperature. The organisms employed included staphylococci, streptococci, meningococci, the diphtheria bacillus and the bacillus of tuberculosis in sputum. They were dried on silk threads and on furniture and other objects likely to carry infective matter. At a temperature below 132° F. the various strengths had but little influence on the diphtheria organisms, but at that temperature a 2 per cent. solution destroyed them within five minutes, and 5 per cent. within a minute. The controls withstood the influence of distilled water at the same temperatures fifteen minutes. As the bacilli are killed in distilled water at 140° F. within a minute, soda at that temperature was not employed. The staphylococci were found to be very resistant to all the solutions, except at the highest temperature, at which they were destroyed within five minutes. The meningococci showed about the same degree of resistance as the streptococci; neither of them can withstand the action of a 5 per cent. solution at 140° F. more than a few minutes. Tuberculous sputum dried on threads, treated with the different solutions at 140° F. for varying periods, and inoculated into guinea-pigs produced no lesions, showing that five minutes' exposure to 2 per cent. or one minute's exposure to 10 per cent. sufficed to destroy the organism.

Experiments to determine what, if any, harmful action the agent would exert on furniture, woodwork, linoleum, carpets, and leather goods and other articles showed that no injury worthy of mention need be expected. It is well in practice to apply the solution and let it dry on the article under treatment, and then to wash later.

The action of this agent on *B. typhosus*, *B. coli*, and Kruse's dysentery bacillus has been studied by Kurpjuweit,¹ who found that all three organisms are destroyed within five minutes by solutions of 2 and 5 per cent. at 122° F.

Corrosive Sublimate. The reaction time of corrosive sublimate in various strengths (1:1000, 1:5000, and 1:10,000) has been studied

¹ Zeitschrift f. Hygiene und Infektionskrankheiten, June 10, 1903, xliii. p. 367.

by Harrington and Walker,¹ whose conclusions are as follows: 1. Different species of pathogenic bacteria and different cultures of the same species vary very greatly in their resistance to the action of corrosive sublimate. 2. With some species resistance is diminished in a remarkable degree by a condition of dryness, so that even the 1:10,000 solution can bring about sterility in a very short time; but some species are not materially affected in this respect by dryness. 3. Corrosive sublimate in as weak solution as 1:5000 is ineffective against the common pathogenic bacteria, including the pus organisms, when they are moist, excepting after prolonged contact. Since fifteen minutes' contact is not sufficient for the destruction of *B. coli communis*, *B. pyocyaneus*, and *staphylococcus pyogenes albus* in the moist state, or of *staphylococcus pyogenes aureus*, whether moist or dry, the use of this and of weaker preparations in surgical work and for irrigation and similar purposes should be abandoned. 4. Corrosive sublimate in the 1:1000 solution is very slow in its action on some of the commonest of the skin bacteria, and since, under the most favorable conditions, more than ten minutes' contact may be necessary for it to kill *staphylococcus pyogenes albus*, it should not be relied upon to any great extent to ensure sterility of the hands or of instruments. The mere dipping of the hands for a few seconds into solutions of this strength can serve no useful purpose, but, on the contrary, can lead to much harm by inducing a false sense of security. In order to produce sterility of the hands through the use of this preparation, absolute dryness of the bacteria present would be essential; but a condition of the skin which would ensure such dryness would also ensure the bacteria not on the very surface against contact with the poison. 5. Corrosive sublimate in any of the strengths commonly employed is a much overrated disinfectant, and, under the best of conditions, is so uncertain in its action that it would be of advantage to abandon its use altogether in surgery.

Alcohol. Experimenting with seven different species of bacteria which were exposed to different concentrations of alcohol for various periods, Harrington and Walker² report the following conclusions: 1. Against dry bacteria, absolute alcohol and ordinary commercial alcohol are wholly devoid of bactericidal power, even with twenty-four hours' direct contact, and other preparations of alcohol containing more than 70 per cent. by volume are weak in this regard according to their content of alcohol—the stronger in alcohol the weaker in action. 2. Against the commoner, non-sporing, pathogenic bacteria in a moist condition, any strength of alcohol above 40 per cent. by volume is effective within

¹ Boston Medical and Surgical Journal, April 23, 1903, p. 435.

² Ibid., May 21, 1903, p. 548.

five minutes, and certain preparations within one minute. 3. Alcohol of less than 40 per cent. strength is too slow in action or too uncertain in results against pathogenic bacteria, whether moist or dry. 4. The most effective dilutions of alcohol against the strongly resistant (non-sporing) bacteria, such as the pus organisms, in the dry state are those containing from 60 to 70 per cent. by volume, which strengths are equally efficient against the same organisms in a moist condition. 5. Unless the bacterial envelope contains a certain amount of moisture it is impervious to strong alcohol; but dried bacteria when brought into contact with dilute alcohol containing from 30 to 60 per cent. of water by volume will absorb the necessary amount of water therefrom very quickly, and then the alcohol itself can reach the cell protoplasm and destroy it. 6. The stronger preparations of alcohol possess no advantage over 60 to 70 per cent. preparations, even when the bacteria are moist; therefore, and since they are inert against dry bacteria, they should not be employed at all as a means of securing an aseptic condition of the skin. 7. Provided the skin bacteria in the deeper parts can be brought into contact with disinfectants, alcohol of 60 to 70 per cent. strength may be depended upon usually, but not always, to destroy them within five minutes.

TUBERCULOSIS.

Human and Bovine Tuberculosis. The question of the identity of the exciting causes of human and bovine tuberculosis has brought forth during the past year a voluminous literature on both sides. Von Baumgarten¹ points out a number of distinct differences between the two diseases. The human disease has a selective affinity for the parenchyma of organs, while that of the bovine species prefers the serous membranes. The tubercles of the bovine disease are, as a rule, not small miliary nodules, but form larger nodules, which may be pedunculated and attached, like pears on a string, to strands of connective tissue. Schanz² believes the two organisms to be identical, but admits that, although the bovine bacillus can produce a local skin affection, *tuberculosis verrucosa cutis*, in man, it cannot produce lupus; and he suggests that some unknown factor besides the specific organism is necessary. Troje,³ however, reports a case which indicates that it is capable of causing lupus. The victim, a young man under twenty years, scratched his arm while assisting at the autopsy of a tuberculous cow. The wound was treated at once with carbolic acid, and promptly

¹ Journal of Tuberculosis, January, 1903, No. 1.

² Wiener klin. Wochenschrift, January 1, 1903.

³ Deutsche med. Wochenschrift, March 12, 1903.

healed. About six weeks afterward inflammation appeared, and nodules developed which did not yield to local treatment. The glands became enlarged and the local condition took on the appearance of lupus. The affected area and the enlarged glands were excised, but the local condition returned, with enlargement of the axillary and infraclavicular glands, which it was necessary to excise. Microscopic examination demonstrated that the condition was tuberculous. Von Behring¹ believes them to be identical, and asserts that young infants develop intestinal tuberculosis because of their lesser resistance and greater exposure (through drinking milk). That the two are identical, but of different degrees of virulence, is suggested by the results of experiments made by Penrose² with tuberculin from bovine bacilli. He believes that the respective tuberculins are identical in their effects on the human system except in degree, the bovine variety being the stronger.

On the question of comparative virulence much experimental work has been performed, the results indicating a much greater degree of virulence for the bacillus of bovine origin. Ravenel,³ who has given much time to the subject, finds that the bovine bacillus shows constant and persistent peculiarities of growth and morphology which enable it to be differentiated from that of human origin. It is much more pathogenic than the latter for all the species of experimental animals (guinea-pigs, rabbits, cats, dogs, goats, calves, sheep, pigs, and horses) used, excepting, possibly, pigs, which appear to be about equally susceptible to both. Indeed, he goes so far as to believe that he is justified in assuming that it is more pathogenic for man himself. His findings with regard to pigs are in agreement with the observations of Tempel,⁴ who noted a number of cases of tuberculosis in hogs in which the disease appeared to have gained entrance through the wound made in the operation of castration.

Four of the animals were apparently infected by an operator with laryngeal tuberculosis, who had the habit of holding his operating knife between his teeth.

Ravenel is not alone in the assumption that the bovine bacillus is more dangerous to man than that of human origin, for Cipollina⁵ expresses the same opinion without qualification. He succeeded in producing general tuberculosis in a healthy ape with milk containing bacilli of bovine tuberculosis, but without lesions of the intestine, and was unsuccessful in his attempt to cause the disease in a calf which he

¹ Wiener klin. Wochenschrift, March 19, 1903.

² Journal of Tuberculosis, October, 1902.

³ Journal of Comparative Medicine and Veterinary Archives, 1902, pp. 65, 139.

⁴ Zeitschrift f. Fleisch- und Milchhygiene, 1902, p. 231.

⁵ Berliner klin. Wochenschrift, February 23, 1903.

inoculated intraperitoneally with bacilli of human origin. Nocard¹ fed three monkeys with a weekly dose of bovine bacilli mixed with their food, which consisted of rice with boiled milk and sugar. The three died in respectively two, three, and four months, and showed lesions which were absolutely identical with those observed in tabes. Three other monkeys, kept as controls, were killed and found to be entirely normal. The difference in virulence of the bovine and human bacilli is shown by the result of another experiment, in which two monkeys were given food mixed with bovine bacilli and two an equal amount of human bacilli. The two former became tuberculous much sooner than the two latter.

The observations of Fibiger and Jensen² are of great interest and importance. They give the clinical history and notes of the post-mortem examination of cases of apparent primary tuberculous infection of the alimentary tract, from which they obtained material for inoculation experiments on calves and cows. It was found that the question, to determine which the experiments were performed, namely, whether the bacilli of chronic intestinal tuberculosis behave differently from those of phthisis pulmonalis, must be answered in the affirmative, for the calves inoculated with material from three such cases showed the bacilli to be exceedingly virulent—so virulent, indeed, as to warrant the conclusion that the original cases were due to infection by the bovine bacillus. The cases, as a whole, showed great variation in the virulence of the bacilli for calves, some yielding organisms with no virulence whatever; and it was observed that it depended upon the age of the patients, being weakest in those from the oldest patients. This suggests that the virulence of the invading organisms is gradually weakened by the attenuating influence of the human system. A similar result was obtained by Wolff,³ who inoculated a healthy calf with material from a case of human intestinal tuberculosis. The calf died in eighty-three days, and autopsy showed general tuberculosis. The tubercles at the seat of inoculation were cheesy and calcified, while those in the more distant parts of the body were newly developed. Klebs and Rievel⁴ have been led by their experiments to believe that tubercle bacilli of human origin can cause tuberculosis in calves after a long period of artificial cultivation. Orth,⁵ also, is of opinion that they may be so increased in virulence as to become pathogenic for domestic animals. His experimental animals were inoculated with

¹ Journal of the Sanitary Institute, January, 1903, p. 571.

² Berliner klin. Wochenschrift, September 22, 1902.

³ Ibid., November 17, 1902.

⁴ Deutsche thierärztliche Wochenschrift, x., No. 3, p. 21.

⁵ Berliner klin. Wochenschrift, 1902, No. 34, p. 793.

bacilli of human tuberculosis, and the material yielded by them was used in testing the susceptibility of calves, hogs, and goats. Two of the calves showed only local changes; one showed general tuberculosis. The hogs yielded like results, but all three of the goats became generally tuberculous. Schottelius¹ succeeded in infecting a cow and two calves with human tubercle bacilli by mingling sputum with their feed. The three animals and two others kept as controls were healthy at the time the experiments were made. After some months the five animals were killed and examined. The controls showed no lesions, but the others were tuberculous, the cow having tuberculous enteritis and swollen mesenteric glands, and the two calves showing tuberculous submaxillary and mesenteric glands. But practically the same experiment conducted by Möller² gave negative results, and led, therefore, to an opposite conclusion. He fed the bacilli to calves, and in addition injected them into the peritoneal cavity, under the skin, and into the veins. Furthermore, the animals were compelled to breathe air in which the dried bacilli were suspended, and yet, with all these exposures, they remained healthy. Dean and Todd,³ also, were unsuccessful in their experiments with human tubercle bacilli which they passed through various species of mammalia prior to injecting them into others to determine whether their virulence is increased. With calves the results were practically negative, at most a few local lesions being produced. Pigs, however, succumbed to general tuberculosis both after injection and from feeding experiments. Ravenel⁴ says, however, that human tubercle bacilli, which have a high degree of virulence for experimental animals, are rarely found, and cultures which are highly pathogenic for cattle are still more rare. He has availed himself of the opportunity, whenever possible, of obtaining cultures from the mesenteric glands of milk-fed children that had died of tuberculosis not clearly of respiratory origin, and in this way has found two cultures, one of which was as virulent for all animals on which it was tested as cultures obtained from cattle usually are, and the other of considerably less virulence, but more potent than the usual human culture.

According to a note in *American Medicine*, July 18, 1903, the Berlin Medical Society recently heard a report from Professor Kossel, of the Tuberculosis Commission. This commission has carried on an extensive investigation relative to the probability of bovine tuberculosis carrying infection to the human subject. The commission's investigations cover

¹ Münchener med. Wochenschrift, September 30, 1902.

² Deutsche med. Wochenschrift, October 2, 1902, p. 718.

³ Lancet, November 1, 1902.

⁴ Journal of the American Medical Association, June 3, 1903.

three forms of introducing tubercle bacilli in calves: first, subcutaneous injection; second, in food; and, third, by inhalation. The preliminary report covers only the first form, but the experiments with the other forms continue. The commission decided to attempt the inoculation of calves not with matter taken directly from human victims, but with cultures made therefrom. The experimentation covered 39 separate cultures, 23 from adults and 16 from children. The results were that 19 calves subcutaneously treated did not show the slightest effect, 9 showed after four months the slightest changes of condition, and 7 showed more marked symptoms, but the propagation of tuberculosis in the body did not occur. On the other hand, 4 inoculations from tuberculous children infected calves with a disease which resembled a weak type of animal tuberculosis, and 2 of this number died from tuberculosis. The commission summarizes as follows: "The series of experiments strengthens Professor Koch's view that animal tuberculosis as the cause of human tuberculosis does not play the rôle generally attributed to it, but definite judgment requires further experimentation."

The various reports that have appeared within the past two years on the communicability of human tuberculosis to cattle are reviewed by Fibiger,¹ who finds that in 41 experiments the disease was induced in 51 of 81 bovine animals employed; and in 74 other experiments, 73 of 108 cattle, swine, and goats yielded positive results. A certain number of successes are reported in other animals, as dogs, cats, horses, asses, and monkeys.

Concerning the possibility of transmission of tuberculosis from animals to man, considerable evidence has been offered. The following interesting case is recorded by Spronck and Hoefnagel.² A man, aged sixty-three years, while skinning a very tuberculous cow was accidentally cut in the little finger of his right hand. The wound healed quickly, but within a few days the place became swollen and hard, and then cracks appeared in the skin. A tubercle formed, and the glands at the elbow became painful and enlarged. Nine months afterward the enlarged glands and the affected area were removed surgically, and were found to be tuberculous. Some of the material was inoculated subcutaneously into guinea-pigs, with positive results. The triturated spleen of one of these animals was inoculated into a heifer of thirteen months, which was shown by the tuberculin test to be in good health. The heifer was kept by itself in a newly built stable, in which no other animal had been kept, and she was fed no milk whatever. Within five days she began to show signs of infection, and these became more and

¹ Hospitalstidende, 1903, Nos. 9 and 10.

² La semaine médicale, October 15, 1902, p. 341.

more marked up to the time, about two months from the day of inoculation, when she was killed. Autopsy showed not alone local lesions, but general infection of the pleura and lungs, enlargement of the bronchial and mediastinal glands, and lesions in other parts of the body. The man himself developed, twenty months after the accident, a catarrh in the right apex; there was slight dulness, with moist râles, but the sputum contained no bacilli. A somewhat similar case is reported by Krause.¹ A robust and healthy workman in an abattoir was slightly wounded in the right hand, and shortly afterward was obliged to skin a cow that had been killed because sick. In a short time the arm swelled as far as the axilla, and a nodule formed at the point of inoculation. The nodule and some enlarged glands were excised, and on examination they yielded tubercle bacilli. It was necessary to have recourse to surgical aid several times, and it was several years before there was complete recovery. There was no sign of tuberculosis in any other part of the body.

Lassar² states that among 108,000 patients who have come under his notice during the past preceding ten years there were thirty-four undoubted cases of inoculation tuberculosis, chiefly in veterinarians, butchers, and others who handle meats. He believes that even this small proportion of cases indicates a serious avoidable danger.

In July, 1902, Garnault allowed a bit of tuberculous tissue from a cow to be inserted under the skin of his arm. Four months later the nodule which developed was removed, and portions of it were inoculated into guinea-pigs, which, in a month, showed marked evidence of tuberculosis. The nodule yielded typical bacilli. The report of the Pasteur Institute³ on the nodule states that the bacilli introduced into the part remained living and virulent for guinea-pigs for a period of four months after transplantation, but that the lesion produced was limited to the point of inoculation. This, of course, can hardly be recorded as a successful demonstration of the transmissibility of bovine tuberculosis to man, but, on the contrary, must be classed as doubtful according to the criterion proposed by Hamilton⁴ and others for determining whether or not an infection has taken place, which is as follows: If it is found that inoculated virus has died at the point of inoculation, and failed to produce tubercles in other parts of the body, the result must be considered negative; if the bacillus is found only in the local lesion at the point of inoculation, and has increased some in numbers, the case may be considered doubtful; if, however, the bacillus

¹ Münchener med. Wochenschrift, June 24, 1903.

² Deutsche med. Wochenschrift, October 2, 1902.

³ Garnault. Gazette médicale de Paris, December 20, 1902.

⁴ British Medical Journal, 1902, p. 944.

is found in the local lesion in a cheesy abscess, and if the adjacent lymphatic glands show a tuberculous structure, the case must be considered as proving the fact of infection. But the number of cases of transmission from animal to man through accidental inoculation through wounds is, on the whole, exceedingly small. Woods Hutchinson¹ has collected a total of 17 cases, or less than 1 case per year, during the past two decades, and in 12 of these only local or cutaneous symptoms resulted. In only 4 of the 17 was there death from involvement of the lungs, "so that our apparent and only proved fatality from bovine tuberculosis by inoculation is 4 cases in twenty years, or one death in five years. This comes exceedingly near what the French term *un quantité négligeable*."

Against the theory of transmission from animal to man, the instance related by von Baumgarten² must be quoted. He was directed by his chief, Rokitansky, to test the supposed antagonism of the tuberculous to the cancerous process by injecting a number of inoperable cases of carcinoma with tuberculous material from bovine sources, and about a dozen patients practically moribund were so treated several times. The result was *nil*; no good result was achieved, and no local or general tuberculous lesions developed.

Raw³ believes that the human body is subject to two separate and distinct forms of tuberculosis, caused by bacilli of human and bovine origin; that the bovine variety is the cause of enlarged glands, lupus, tuberculous joints, and tabes mesentericus; and that the true human tuberculosis, phthisis pulmonalis, is transmitted solely from person to person, and generally from advanced cases.

However authorities disagree as to the identity or non-identity of the human and bovine forms of tuberculosis, in one important matter there is substantial agreement, namely, that tuberculosis in animals is of less importance to man than the disease in other human beings. The chief source of danger to man is the disease in man; and while it is desirable to limit the disease as much as possible in animals, and to employ all reasonable safeguards against possible infection of man by animals, the main point in the fight against the disease is the prevention of spread from man to man by improved hygiene of dwellings, workshops, etc., by isolation, and by education of the people as to the infectiousness of tuberculous sputum and the necessity of its total destruction.

Is the Milk of Tuberculous Cows Dangerous? Concerning the danger of drinking the milk of tuberculous animals, Woods Hutchinson⁴ calls attention to the fact that the actual number of cases of tuberculosis

¹ American Medicine, April 18, 1903.

² Journal of Tuberculosis, January, 1903.

³ British Medical Journal, January 31, 1903, p. 247.

⁴ American Medicine, April 18, 1903, p. 618.

on record as due to this cause is but thirty-seven. He says: "As this question has been before the medical and veterinary professions for at least twenty-five years, and several of the most frequently quoted cases date back twenty years, this most inadequate number is really significant. Thirty-seven alleged cases in twenty years from the whole civilized world! Granting the validity of every case, human tuberculosis of bovine origin is a rarer disease than leprosy! A disease which numbers but two victims a year is certainly not a serious menace to civilization. It is only fair to add that while, of course, these figures can by no means be regarded as representing the whole or even the proportional risk of infection from bovine sources, yet in view of the fact that veterinarians have been most alert and watchful for all cases of human disease of this origin, especially since more than half of them have been devoting themselves chiefly to meat- and milk-inspection—a service of priceless value to the race, and which is far from being appreciated as it deserves—and that at least half of these thirty-seven cases are open to most serious doubt of their authenticity, when carefully studied they do furnish a rough index of its probable frequency." He shows, further, "that while the census returns of every civilized country in the world show an increase in the amounts of meat, milk, butter, and cream consumed per capita of from 200 per cent. to 400 per cent. in the past thirty years, the mortality from tuberculosis during the same period has declined 30 to 45 per cent." Also, that "every attempt to connect in any definite way tuberculosis with either meat or milk supply, whether by royal commission, as in England and Denmark, by veterinary inspection boards, as in France and Germany, has failed utterly. Increased use of meat and milk has, on the contrary, in every class, country, age, or condition, been found associated with a decreased death-rate from tuberculosis." Furthermore, "although tuberculosis has been proved to be present in from 2 per cent. to 52 per cent. (Schleswig-Holstein) of dairy cattle, nowhere (outside of insane asylums and cloisters) does it reach in human beings a prevalence of much more than one-tenth of this degree, viz., from 2 to 5 per 100 living. Nor does the highest bovine prevalence coincide in any way with the highest human death rate."

Hüls¹ has reported the case of a family of nine in which, in the course of five years following the introduction of a new strain of cattle which proved to be infected with tuberculosis, seven deaths occurred from the disease. The case is reviewed by Koch,² who concludes that there is no proof adduced to demonstrate that the infection of the family was due to milk. He shows, moreover, that the oft-quoted case reported

¹ Münchener med. Wochenschrift, June 17, 1902.

² Deutsche med. Wochenschrift, November 27, 1902.

by Ollivier, in which a number of girls in a boarding-school died of tuberculosis, which was traced to the milk of a tuberculous cow, has no value as evidence, since careful investigation has demonstrated the fact that none of the pupils consumed the milk, which, in fact, was given to the servants, none of whom suffered any ill effects therefrom.

In the opinion of McWeeny¹ it is desirable that tuberculous cows be divided, for purposes of experimentation and discussion, into three classes: those which show clinical symptoms of tuberculosis, those which are affected with tuberculosis of the udder, and those which react to tuberculin, but show no clinical symptoms of the disease. His experiments were made with five cows of the third class, to which class it is believed that more than half of all the cows of Germany and Great Britain belong. The udders of the five cows were carefully cleaned before milking, and the milk was passed through a centrifuge; the sediment collected at the bottom was then used for inoculating guinea-pigs, a quantity of the cream being inoculated into the side of each experimental animal at the same time. The total number of experiments performed was twenty-three, and the results were completely negative and in accord with those of Ostertag, who was likewise unable to find tubercle bacilli in the milk of cows which merely reacted to tuberculin, but which did not give clinical evidence of the disease.

At the Government Asylum for the Insane at St. Elizabeth, D. C., 102 cows were tested with tuberculin, and 76 of them gave a decided reaction; 1 other showed a questionable rise. Of the remaining 25 that did not react, 13 had recently been bought in Virginia, and had been kept by themselves during the two weeks they had been on the place. Excluding these 13, the percentage of reacting cows was more than 85. Physical examination led to the immediate destruction of 12, 10 of which had reacted, the other 2 being otherwise sick. It was decided to ascertain, as far as possible, to what extent the milk of the reacting cows contained the tubercle bacillus. Milk from tuberculous udders is well known to be infective to experimental animals, and that from cows with general tuberculosis may contain the bacilli in the absence of lesions of the udder. At times, also, cows with localized or incipient tuberculosis may yield the bacilli in their milk, the udders being perfectly normal. In order to determine more definitely the relation which exists between the clinical aspect of cows that have reacted to the tuberculin test, but which on physical examination are apparently healthy, and the infectivity of their milk, it was decided to ascertain, through feeding and inoculation experiments, whether the milk of the cows in question contained virulent tubercle bacilli, and, if

¹ Journal Department of Agriculture and Technical Instruction, Ireland, 1902, p. 662.

so, to what extent. Fifty-six of the reacting cows were included in the experiments ; the others were not included, because they were not in milk. The extensive series of experiments conducted by Dr. John R. Mohler¹ led to the following conclusions: 1. The tubercle bacillus may be demonstrated in milk from tuberculous cows when the udders show no perceptible evidence of disease, either macroscopically or microscopically. 2. The bacillus of tuberculosis may be excreted from such an udder in sufficient numbers to produce infection in experimental animals both by ingestion and inoculation. 3. In cows suffering from tuberculosis the udder may, therefore, become affected at any moment. 4. The presence of the tubercle bacillus in the milk of tuberculous cows is not constant, but varies from day to day. 5. Cows secreting virulent milk may be affected with tuberculosis to a degree that can be detected only by the tuberculin test. 6. The physical examination or general appearance of the animal cannot foretell the infectiveness of the milk. 7. The milk of all cows which have reacted to the tuberculin test should be considered as suspicious, and should be subjected to sterilization before using. 8. Still better, tuberculous cows should not be used for general dairy purposes.

To determine the effects of prolonged feeding with the sterilized milk of tuberculous animals, Michelazzi² experimented with four sheep, three lambs, three cows, a calf, and 208 guinea-pigs. It is a common idea that if cows' milk is sterilized no harm can come to the consumer thereof, but we know that a temperature of 100° C. (212° F.) does not destroy the activity of the toxin of the tubercle bacillus, and that much harm can come to the child therefrom. He observed that in several guinea-pigs fed upon healthy sterilized milk there was at first a slight loss of weight, but this loss was very quickly regained, and increase in weight continued ; but when they were fed with the sterilized milk of tuberculous sheep the weight invariably fell to a serious extent, and there was no subsequent recovery of weight, and after a time, never very long, death occurred. The post-mortem examination presented the usual features of chronic, slowly developing tuberculosis. There was marked wasting, slight atrophy of the internal organs ; stasis in the spleen, liver, and lungs ; degeneration of the kidney, and often a transudation of serous fluid into the abdominal cavity. Other guinea-pigs were fed with healthy milk to which a small quantity of tuberculin was added, and the same changes were found. A third series of guinea-pigs was injected under the skin with the raw milk of tuberculous sheep, and no tuberculous lesion was found, but

¹ Bulletin No. 44, Bureau of Animal Industry, Washington, 1903.

² *Annali d'igiene sperimentale*, xi. No. 2.

there was marked wasting of the body. It would appear that the toxin exercises a persistent influence, for the wasting and general failure of nutrition that resulted from the employment of sterilized tuberculous milk persisted in spite of the discontinuance of that particular milk and the placing of the animal in perfectly healthy surroundings.

According to Schlossman,¹ the frequency of tuberculosis in childhood, particularly among nurslings, varies within considerable limits, according to the reports which come from different authors and from different localities, although it appears as if with one and the same material great differences occur concerning the frequency of tuberculous affections in the nursing age. In the nursing age the pure tuberculosis without mixed infection is the most common. In many cases it goes on without fever. In the majority of cases one is not able to prove the tubercle bacilli in the sputum or mucus drawn out by suction. Sometimes sputum which gives negative microscopic results will produce infection by inoculation. He has been able only seldom to find the bacilli in the excreta. The single diagnostic aid in establishing the diagnosis is tuberculin, and he considers its employment in infant asylums as necessary in order to avoid infection. Primary tuberculosis of the digestive tract he has never found, and he regards it as most extremely rare. The diagnosis can be made only by the microscope or through animal experimentation. The intestinal tract of sucklings appears to be infectable only with difficulty, and even frequent swallowing of the tubercle bacilli, as from the saliva of the mother, does not lead to a tuberculosis of the intestine or of the mesenteric glands. An infection of the mesenteric glands is not always conditioned on the wandering of the tubercle bacilli from the intestine, but can also follow in the lymph tract, through the diaphragm from the bronchial glands. A characteristic of tuberculosis in sucklings is the early involvement of the bronchial glands, sometimes at the bifurcation. Sometimes the primary seat is found to be the tonsils. Tuberculous infection through the use of milk plays no sort of rôle in Germany in the etiology of tuberculosis of sucklings.

The unreliability of statistics of primary intestinal tuberculosis is again pointed out by Koch,² some authors placing it as low as 1.4 per cent. and others as high as 37.8 per cent. In fifteen months, in spite of repeated requests, he had not a single case reported to him from all the laboratories and hospitals in Germany of intestinal tuberculosis possibly due to the use of milk of tuberculous cows. If milk can cause tuberculosis, he is of the opinion that cases should occur in groups, and this does not happen. The same can be said also of tuberculous meat,

¹ *Centralblatt f. Bakteriologie, etc.*, February 3, 1903, vol. xxxii. p. 644.

² *Deutsche med. Wochenschrift*, November 27, 1902.

which, though doubtless eaten by all persons at some time during their lives, has never yet been proved to have caused a single case of tuberculosis. Hansemann¹ has seen twenty-five cases of primary intestinal tuberculosis in a very large number of autopsies, and concludes that it is a very rare condition, occurring chiefly in those who are old, or very sick, or especially susceptible. He asserts that no case has yet been found in which phthisis has been proved to follow primary intestinal lesions.

Measures against the Spread of Tuberculosis. Dr. Hermann M. Biggs² gives an interesting account of the sanitary measures which have been taken for the prevention of tuberculosis in New York City, and their results. The methods now employed by the Department of Health of that city for this purpose had their inception in 1888, when the sanitary importance of the various tuberculous diseases was urged by Biggs upon the board. In the following year a communication made to the department by Biggs and the associated consulting pathologists of the department, setting forth the essential facts regarding the nature of the disease, the usual methods of its transmission, and the precautions necessary to prevent its spread, was printed and widely distributed, and, at the same time, small circulars of information were distributed in the tenement-house district, and the public was further educated through the columns of the press. No further action was taken, however, until 1893, when the authorities took measures to require all public institutions to report all cases of pulmonary tuberculosis coming under observation, and, at the same time, all physicians were *requested* to report cases occurring in private practice. Provision was made for the gratuitous bacteriological examination of sputum from cases occurring in private practice, for the visitation of cases not under private care, for the inspection and disinfection, or, if necessary, the renovation of premises vacated by consumptives, and for the disinfection of infected bedding, clothing, etc. In January, 1897, it was decided that the measures carried on under the resolution passed in 1893 should be given increased legal force by the adoption of an amendment to the Sanitary Code relating to the control of the disease, and, accordingly, a section was added declaring pulmonary tuberculosis to be an infectious and communicable disease, dangerous to the public health, and requiring physicians and others to report all cases coming under observation. During 1894, the year in which registration was begun, 4263 cases were reported. In 1897, 9572 cases, and in 1901, 17,588 cases (including 4191 duplicates) were reported.

¹ Berliner klin. Wochenschrift, February 23, 1903.

² Journal of the American Medical Association, December 27, 1902, p. 1635.

The records of living cases and of deaths are preserved by a method of double card cataloguing; they are kept alphabetically and by streets in the order of the house numbers. All cases are platted also on a series of maps, 110 in number, which cover the whole of Manhattan Island. These maps are so arranged that they represent the sanitary districts of the United States census of 1890, and already show most interesting facts. Thus, on a single street block as many as 102 cases have been reported within four and three-quarter years, and as many as 24 cases in a single house. In another block, bounded by four streets and containing a population of 3688, there were 241 cases, and in a third, with a population of 2102, there were 206 cases. These three districts represent, perhaps, the worst conditions existing in the city, but other districts yield nearly as large results. He believes that at least half as many more cases should be added to cover those unreported.

It is interesting to note the evidence of increased confidence on the part of the profession, which is shown by the increase in the number of specimens of sputum submitted for examination. The number increased from 511 in 1894 to 6744 in 1901, and Biggs estimated that in 1902 the number would be more than 7500.

All cases reported, excepting those of certain patients in the care of private physicians, are assigned to the medical inspector of tuberculosis for the respective districts. This official visits the premises, and, if the patient is living, leaves a circular of information and gives verbal instruction concerning the danger of infection and the care of the sputum. If the patient is dead or has moved, the inspector examines the premises and makes such recommendations as he may deem necessary for the disinfection of the premises. The routine treatment of premises includes washing kalsomined or whitewashed walls or ceilings with hot solution of washing soda, one-half pound to three gallons of hot water, and then kalsomining or whitewashing again; washing in the same way and repapering papered walls or ceilings; the scrubbing of woodwork with the soda solution, and painting. The owner of the premises is required to carry out the orders of the board, based on the inspector's recommendations, and he is given ten days in which to do so. Biggs calls attention to the fact that in this plan renovation rather than disinfection is called for, and that renovation is always appreciated by the tenant, and, being understood by all, is more efficient than any method of disinfection which can be employed; that the latter process, in addition, often leaves the premises in an undesirable condition for occupancy.

The attempt has been made to have infected bedding, carpets, etc., disinfected at the public disinfecting station; but this has been only partially successful, since often a considerable interval elapses between the death of the patient and the visit of the inspector, and in the mean time

the goods may have been washed, destroyed, or sent away to be cleaned. In the prosecution of the whole scheme certain difficulties have been encountered, chiefly in the matter of obtaining full registration of cases, for many private practitioners do not report their cases; and the reports from institutions, which naturally furnish the largest proportion of the cases recorded, are in some instances inaccurate. Again, many patients give incorrect addresses intentionally, and thus many false addresses reach the department, and are excluded from the records only after the visit of the inspector. The results of the work thus far accomplished lie in the diminution of the death rate, in the education of the people in the matter of the infectious nature of the disease and the means to be taken for its prevention, and in the destruction of infective matter by the renovation of infected apartments. Biggs doubts that any large measure of education in the necessity of care of the sputum can be hoped for among the non-English speaking inhabitants of the poorest tenement-house districts, which are continuously recruited from the most filthy and ignorant classes of Europe. But among the better class of tenements inhabited by English-speaking people there is great hope.

Of great importance is the influence of the records of the Health Department of New York City on the action of other sanitary authorities both in the State and beyond its borders. Similar measures have been adopted in many other cities in this country and abroad, and by State Boards of New York and other States. But the restrictive measures even in New York have only begun. The most practical necessities of the future are enumerated as follows:

1. Larger and better equipped hospitals for the treatment of advanced cases.
2. Municipal sanatoria for the care of incipient cases.
3. The inspection of factories, shops, and all other places where phthisical patients may be found, and a more strict enforcement of the sanitary ordinance prohibiting spitting in public places.

According to a note in the *Journal of the American Medical Association*, the first regulation requiring notification of pulmonary tuberculosis was issued in Spain in 1751. The decree enjoined destruction of the furniture and wearing apparel used by consumptives, and the replastering of the rooms after death. Failure to notify the authorities of the existence of the disease on the death of the patient was punishable by a fine of two hundred ducats and suspension for one year for the first offence, and four hundred ducats and exile for four years for the second offence. Nurses, servants, and others waiting on the consumptive were required to see that the authorities were notified of the case under penalty of thirty days' imprisonment for the first offence, and four years at the galleys for the second.

Decrease in Prevalence of Tuberculosis. The decrease in the amount of pulmonary tuberculosis is strikingly shown by Dr. Alfred Hillier,¹ who points out that at the present rate of decrease in the mortality from this disease it will have disappeared in Prussia in about twenty-five years, while in England at that time there will be about one death per thousand, and total extinction will require about twenty years longer. From 1876 to 1886 the Prussian rate of deaths from all forms of tuberculosis was stationary at about three per thousand, but from 1887 to 1900 the rate dropped steadily to about two per thousand, or about 33.3 per cent. The rapid fall in the rate in Prussia is ascribed to the precautions taken against infection; to improved conditions of the working classes brought about by the Workmen's Insurance Laws, the first of which, the Sick Insurance Law, came into existence in 1883; and, third, to the establishment of sanatoria. The last-mentioned influence Koch believes to have played some part, but he does not believe that the institutions have yet become sufficiently numerous to form the chief factor in the decline. He believes that the chief factor is the knowledge of the infectious nature of phthisis and the precautions brought gradually into practice even among the lowest classes. He believes that, from a preventive point of view, neither England nor Germany has as yet provided to a sufficient extent the most essential of all institutions, the institution for advanced cases. He regards the early cases of tuberculosis as a danger, but as a trifling danger compared to the advanced and fatal cases. The most terrible source of infection is, in Koch's opinion, the victim who, after a few months in a general hospital, finding himself worse rather than better, goes home to die. The education in him dies before he does, and every cough, sneeze, or attempt at speech sends forth spray containing the virulent bacilli. Such cases, he thinks, ought to be isolated where their days may be made as pleasant as possible, but where they may be under such supervision that when they die they may have the consolation of knowing that they are not leaving a legacy of tragedy to others.

Asked by Hillier if the danger of these extreme cases would still be great were the sputum of all consumptive cases properly collected and sterilized, Koch answered that he is convinced that, dangerous as sputum is when left to dry and pulverize, and essential as it is to control sputum by collecting it in spittoons and destroying its virulence, it is the microbe-laden spray sent forth by the consumptive in his last stages that is by far the most deadly method of conveying the disease. To this opinion he has been led by the numerous experiments with pulverized sputum and with the microbe-laden spray. Of the

¹ Public Health, March, 1903, p. 301.

more recent experiments on this subject are those of Heymann¹ and of Nenninger.² The former calls attention to the fact that Koeniger, Kirstein, Hutchinson, and others, who have studied the subject of infection through droplets expelled from the air-passages through sneezing, coughing, and speaking, have not employed the bacillus of tuberculosis in their experiments, but have made use of other bacteria. In a series of experiments conducted by himself he made use of a glass cabinet of three cubic metres' capacity, in which coughing consumptives were confined up to one and one-half hours. Dishes and plates were placed in different situations within the cabinet, for the purpose of catching the expelled droplets, and at the end of each exposure these were rinsed out and rubbed with a small amount of broth, which was then injected into the peritoneal cavity of guinea-pigs, which, after ten or twelve weeks, indicated by their condition whether or not virulent bacilli had been thrown out. He demonstrated that some individuals produce at times, not only in front but on all sides, a mist of droplets containing living germs. The majority of these droplets are large and settle quickly, but some are very small and are projected more than a metre, and remain in suspension sometimes more than an hour. These results demonstrate the importance of holding a handkerchief before the mouth while coughing. The duration of life of the bacilli within the droplets was determined as eighteen days when protected from light, and three days when exposed thereto. A second series of observations concerning the formation and movement of tuberculous dust from dried deposits on carpets, floor-boards, and handkerchiefs showed that the last-mentioned objects are more causative of danger than the others, since when they are rubbed or waved they give off a very fine dust which remains a long time in suspension, while that stirred up from carpets and floor-boards through ordinary mechanical means is sent but a short distance into the air, and soon settles back. He concludes that dust is considerably less dangerous as a carrier of infection than droplets.

One of the most prolific causes of the spread of tuberculosis in Europe is said by Landouzy³ to be the maintenance of large standing armies. During the past eight years France alone lost 36,000 young soldiers on account of the disease. Other causes are alcohol and overcrowding.

Destruction of Tuberculous Sputum. Since it has been shown that the former belief that tubercle bacilli will perish in a few weeks in foul liquids is incorrect, due consideration must be paid to their destruction before they are admitted to sewage. Steinitz⁴ has made some tests of chemical disinfectants on fresh sputum, and found that iodine trichloride

¹ *Zeitschrift f. Hygiene und Infektionskrankheiten*, xxxviii. p. 21.

² *Ibid.*, p. 94.

³ *La presse médicale*, 1903, No. 27.

⁴ *Zeitschrift f. Hygiene und Infektionskrankheiten*, xxxviii. p. 118.

is not sure and formalin is inadequate. Hydrochloric acid is satisfactory only when used in strength of at least 1:10 with heat; on the contrary, sublimate solutions kill with great certainty, thus: 5:1000 in an hour and a half; 2:1000 in from three to five hours; 1:1000 in from six to eight hours. The iodine compound and formalin acted much better on sputum dried on handkerchiefs than on the fresh sputum, but they were outstripped in efficiency by sublimate, which killed the bacilli every time in five hours without fail when used in the strength of 1:1000. Heat is much more quick and certain. The author recommends combustible cups made of paper stock. They cost about a cent, and can be filled with moist or dried peat, sawdust, or other material. He suggests, also, that cups and bottles which can be disinfected by boiling may be used; also combustible paper handkerchiefs.

Contamination of Meat with Tubercle Bacilli. To determine whether, in the process of slaughtering and in the practice of inspection, sound meat may become infected by the knives and other implements, Decker¹ examined thirteen knives used by inspectors, and found the tubercle bacillus on all but three. Of nine butcher-knives three were found to be infected; and of forty-seven specimens of meat and meat products handled in the ordinary manner nearly half were contaminated with virulent bacilli.

TYPHOID FEVER.

Flies as Disseminators of Typhoid Fever. Concerning the ability of flies to disseminate the germs of typhoid fever, research has been active and fruitful. Ficker² calls attention to the paucity of definite experimental data on the subject, and reports the results of work performed by him in attempting to determine two questions: 1. Can flies that have fed on pure cultures of typhoid bacilli convey the infection, and, if so, how long? 2. What is the fate of the bacilli in the different organs of the body? In the course of his experiments he kept common house flies in a glass flask of ten litres' capacity, in which they were fed on typhoid bacilli and sugar. They were kept in this flask for about a day, and then were carried over into another vessel. He noted, among other things, that flies kept under such conditions are extraordinarily susceptible to changes in temperature. He found that he could keep eight to twelve flies in a space of one to two litres, feeding them with sugar, bread, and water, or milk, for four weeks if they were protected

¹ Zeitschrift f. Fleisch- und Milchhygiene, 1902, p. 225.

² Archiv f. Hygiene, xlv. p. 274.

against decided fall in temperature; and he suggests that in feeding experiments with flies it is well to bear in mind how susceptible they are to temperature, since otherwise one might note a great mortality among them and attribute it wrongfully to the infected food. One single cold night will kill flies imprisoned in this manner, whether they are fed with infected or non-infected material. They must have some protection against cold. None of his flies fed on typhoid bacilli died. Having been transferred into a second flask, they were removed every two or three days into fresh sterilized flasks or separating funnels. Finally they were killed by means of ether vapor, and then were rubbed up in sterile dishes with sterilized broth, and from this mixture gelatin plates were made. His results in brief are as follows :

Experiment No. 1 : Sixteen flies were fed eighteen hours. They showed bacilli on the third and fifth day after feeding, but not on the sixth, eighth, twelfth, and fourteenth. 2. Twelve flies were fed eighteen hours. The organisms were demonstrated on the fifth and eighth days, but not on the sixth, eleventh, fourteenth, and sixteenth. 3. Twelve flies, fed twenty-four hours, showed the organisms on the third, sixth, and eleventh, but not on the eighth, thirteenth, and sixteenth days after feeding. 4. Twenty-one flies, fed twenty hours, showed the organisms on the third, fifth, and seventh, but not on the ninth, twelfth, and fifteenth days. 5. Nineteen flies, fed twenty hours, showed the organisms on the third, fifth, seventh, ninth, eleventh, fifteenth, nineteenth, and twenty-third days, but not on the twelfth, seventeenth, twenty-fifth, and twenty-seventh days after feeding.

It appears, therefore, from these experiments, that flies that are fed with typhoid bacilli may carry infection to objects on which they alight as late as twenty-three days after feeding.

Further experiments dealt with the location of the typhoid bacilli within the flies. It is practically impossible, on account of the smallness of the internal organs of the fly, to bring about a completely aseptic removal of the same for purposes of cultural examination. He carried out a very careful examination of dead flies, and arrived at the conclusion that in the intestine the organisms are to be found as late as the ninth day, and even later. He found that flies harbor a variety of organisms in their intestines. In flies which he caught in a stable, proteus vulgaris dominated, and proteus-like organisms and the hay bacillus were also found. The kitchen flies contained a great many cocci, together with the proteus varieties; but the colon group were relatively scarce. He closes by calling attention to the ease with which flies under natural conditions are in a position to take up and disseminate typhoid organisms. They have a junketing disposition, they go in swarms, and they have the peculiarity of tasting and fouling every-

thing with which they come in contact. They are ubiquitous : they visit the sick-rooms and every other sort of room, and every kind of place out-of-doors ; and they have, in addition, a great preference for the kitchen and dining-room, and for places where milk, vegetables, meats, etc., are exposed ; so that there are thousands of possibilities for taking up bacteria and spreading them about.

That flies that have visited privy vaults can afterward deposit living typhoid bacilli on foods a considerable distance away has been proved by Dr. Alice Hamilton,¹ who selected as one place for examination an unconnected privy in which the discharges from two cases of typhoid fever had been and were being thrown without any attempt at disinfection. The discharges lay within three feet of the opening, and had been caught also on a projecting scantling within a foot thereof. Specimens of the common house fly caught within a vault and on the fence in the yard, and inside the sick-room of one of the patients, which was used also as a kitchen, were planted, and in two instances the typhoid organism was found to be present. In another place, a yard in which was a large, full, and filthy vault used by sixteen families, flies were caught both in the privies over the cesspool and from the fence, as well as the walls of the two houses bounding the yard at varying distances from the vault ; and from three specimens, one from each place, the specific bacilli were isolated.

Since the conditions found at these two places are common in such neighborhoods, where food is likely to be exposed to a greater or lesser extent, and the houses are not likely to be screened, it can, in Dr. Hamilton's opinion, easily be seen what an important part the common house fly may play in the spread of typhoid infection.

Firth and Horrocks² have made a study of the influence of soil, fabrics, and flies in the dissemination of typhoid fever, and come to the following conclusions, which are equally applicable to enteric bacilli recently isolated from stools and to old cultures of the organism which have been in the laboratory for many months : 1. There is no evidence to show that the enteric bacillus when placed in soil displays any disposition or ability either to increase in numbers or to grow upward, downward, or laterally. 2. The enteric bacillus can be washed through at least eighteen inches of soil by means of water, even when the soil is closely packed down and no fissures or cracks allowed to exist. 3. The enteric bacillus is able to assume a vegetative existence in ordinary and sewage-polluted soil and survive therein for varying periods, amounting in some cases to seventy-four days. 4. The presence or absence of

¹ *Journal of the American Medical Association*, February 28, 1903.

² *British Medical Journal*, September 27, 1902, p. 936.

organic nutritive material in the soil appears to be largely a negligible factor, since the enteric bacillus can survive in a soil indifferently well, whether it be an organically polluted soil or a virgin soil, and whether it receive dilute sewage or merely rain water. 5. An excess or great deficiency of moisture in soils appears to be the dominant factor affecting the chances of survival of the enteric bacillus in, or at least the possibility of recovering it from, soil. 6. From fine sand allowed to become dry the enteric bacillus can be recovered on the twenty-fifth day after inoculation. 7. From fine sand kept moist with either rain or dilute sewage the enteric bacillus cannot be recovered later than the twelfth day after fouling; this inability to recover the organism is due probably not so much to its death as to its being washed down into the deeper sand layers by liquids added. 8. In peat the enteric bacillus appears to die out rapidly, as it cannot be recovered from it after the thirteenth day; but this soil is so porous that it is quite possible that the micro-organism was washed down into the deeper parts, and consequently not recoverable from the place of inoculation. 9. From ordinary soil kept damp by occasional additions of rain water the enteric bacillus can be recovered up to and on the sixty-seventh day. 10. From a similar soil kept damp by addition of dilute raw sewage the enteric bacillus is recoverable up to the fifty-third day. 11. From a similar soil kept damp by occasional additions of dilute sterile sewage the enteric bacillus is recoverable up to the seventy-fourth day. 12. In a similar soil after a heavy rainfall the enteric bacillus disappears at once from the surface layers. 13. From a similar soil allowed after inoculation to become so dry as readily to be blown about as dust the enteric bacillus can be recovered up to and on the twenty-fifth day; and enteric infective material can be readily translated from dry soil and sand by means of winds and air currents. 14. In a sewage-polluted soil recovered from beneath a broken drain the enteric bacillus is able to survive up to the sixty-fifth day. 15. From a piece of khaki drill inoculated with an emulsion of enteric bacillus and then allowed to dry, the bacillus is recoverable up to and on the seventy-fourth day. 16. From a piece of khaki serge similarly treated the enteric bacillus is recoverable up to and on the eighty-seventh day. 17. From a piece of blue serge similarly treated the enteric bacillus is recoverable on the seventy-eighth day. 18. From a piece of khaki drill fouled by liquid enteric fæces and then allowed to dry the micro-organism is recoverable on the seventeenth day. 19. From a similar fabric fouled by solid or semisolid enteric fæces and then allowed to dry the micro-organism is recoverable on the ninth day. 20. The enteric bacillus is able to survive in surface soil an exposure to one hundred and twenty-two hours of direct sunshine, extending over a period of twenty-one consecutive days. From

a piece of infected serge the enteric bacillus is recoverable after the fabric has been exposed to fifty hours of direct sunshine spread over a period of ten days. 21. Ordinary house flies (*musca domestica*) can convey enteric infective matter from specific excreta or other polluted material to objects on which they may walk, rest, or feed. Such infective material appears to be attached not only to their heads (mandibles, probably), but also to their legs, wings, and bodies. It has not been proved that the enteric bacillus passes through the digestive tract of the fly.

Viability of the Typhoid Bacillus. Martin has asserted that the typhoid bacillus is destroyed in unsterilized soil in less than twelve days, and Houston is of opinion "that there is no indication that the addition of sewage to soil leads to a marked or any temporary increase of the sewage microbes in general at the expense of the soil bacteria. On the contrary, the more hardy soil bacteria seem to oust the more delicate sewage microbes in the struggle for existence." Firth,¹ whose work with Horrocks has already been mentioned, asserts that the investigation on the viability of the germ in soil, whether wet or dry, demonstrates the risks attending the dry-earth system, which may be the source of typhoid infection. In the water-carriage system the danger of local infection is practically absent, but the final management and disposal of sewage by certain methods suggests elements of risk. He believes that there is no reason to assume that the germ will die in the struggle for existence with other bacteria, or that it will be destroyed by any of the bacteriological processes of sewage treatment, or that it will be retained in contact beds, and hence it seems unlikely that treatment following the biological processes will bring certain safety. It is true that recovery of the germ from purified sewage has not yet been reported, but it may be only a question of time and improved technique.

The fact that epidemiological data indicate that the typhoid bacillus outside the body can live and retain its infectivity for months and perhaps years led Levy and Kayser² to make an investigation which yielded most interesting results. The fæces of a typhoid patient were discharged into a cemented vault, remained therein five months, and were then spread as manure on a clay soil, from which after fifteen days of winter weather the specific organism was isolated. They come to the natural conclusion that typhoid stools should always be disinfected before being discharged into a privy vault.

Water in its Relation to Typhoid Fever. The number of deaths from typhoid fever in Massachusetts is shown by the vital statistics to

¹ Journal of the Sanitary Institute, January, 1903, p. 614.

² Centralblatt f. Bakteriologie, etc., March 20, 1903, Abth. I., xxxiii. p. 489.

have been smaller in 1901 than in any single year since the beginning of registration, in 1842, when the population of the whole State was no larger than that of Boston and the immediate suburbs to-day. In 1901, in thirty-three cities, the death rate from this disease was only a trifle more than one-fourth as large as it was in the same places thirty years ago. In the ten years ending in 1865, only one-fourth of the population used water which was under the control of the public authorities, and in those years the typhoid fever death rate was 9.29 per 10,000. In 1875, 41 per cent. of the population had public water supplies, and the death rate from this disease had decreased to 8 per 10,000. In the year 1901, 90 per cent. of the population was supplied with public water systems, and the death rate had been reduced to 1.95 per 10,000.

From time to time the public receives a lesson in the importance of maintaining pure water supplies. These lessons come always in the form of epidemics of typhoid fever of greater or lesser extent. During the continuance of such an epidemic, and immediately after, the public is greatly interested in the subject; but in the course of time, with the vast majority, interest dies out until another epidemic occurs. Nevertheless, with each lesson something is accomplished, for public authorities become stimulated to take action to prevent, so far as their own particular communities are concerned, further trouble. The latest large outbreak is certain to have much more than a local effect, since its casualties were much more than a matter of purely local concern; for, occurring in a town which is the seat of a great university which draws its students from all parts of the country, it numbered among its victims a large number of non-residents. This is the epidemic at Ithaca, New York, which city has a population of about seventeen thousand inhabitants, including three thousand students of Cornell University. Part of the town is on level ground, but a large part, including the University grounds, is on hills which are intersected by deep gorges through which small bodies of water that rise in the surrounding country flow on their way to Lake Cayuga. The water supply is derived from three of these creeks, one of which, Six Mile Creek, is believed to have furnished all of the infection. The watershed of this creek is about forty-eight square miles of thickly populated farming land, on which are three small villages; it is slightly more than ten miles in length and very narrow. The stream is small, and the average flow during January and February was estimated at five to six million gallons. For a long time the water supply has been looked upon as suspicious, and Dr. M. T. Sudler,¹ of Cornell University, states that

¹ Philadelphia Medical Journal, April 11, 1903, p. 632.

on his arrival at Ithaca, in the autumn of 1902, he was warned against it, and was told of an outbreak of so-called "Ithaca fever" or "Six Mile Creek colitis." According to the report of the special commissioner of the American Medical Association,¹ typhoid fever has rarely been absent, and in 1902 cases were especially numerous. During the year 1901-1902 no less than eighteen cases of typhoid fever were cared for at the University Infirmary alone. During January and February, 1902, it is said that there were nearly one hundred cases in the town. Between November 17, 1902, and January 15, 1903, there were about fourteen cases of low fever described as "possibly typhoid." On January 1st five or six cases of undoubted typhoid fever developed, and during the following week several cases were reported each day. After January 25th the number reported daily increased very materially, but as early as January 22d it had appeared necessary to warn the public through the newspapers to boil all the water used for drinking. On February 2d it was evident that the condition was very grave, and it was announced in the local press that an epidemic of typhoid fever was spreading with terrible rapidity; that the physicians were overworked, the hospitals overcrowded, and the nurses insufficient in number. So far as could be ascertained, the number of cases which developed prior to March 12th was 770, but the actual number was probably higher; some observers said that the number of cases exceeded one thousand. Among the students of Cornell University the epidemic found many victims. On March 12th no less than 119 students had been seized, 12 of whom had died in Ithaca and 10 at their homes. The number of students who sickened after they left Ithaca on account of the presence of the fever was more than one hundred. In all, it is believed that between January 1st and March 12th no less than 183 students and 668 towns-people, or a total of 851, contracted the disease in Ithaca. A revised and corrected tabulation of cases on the best information obtainable March 30th gave 230 students and 682 citizens, or a total of 912 cases.

Typhoid Fever Traced to Infected Butter. A new source of infection with typhoid fever is suggested by C. F. Davidson,² who investigated thirty cases of the disease in Easton, Maryland, which place obtains its drinking water from a well 1072 feet deep. Only one of the patients, an adult woman, drank exclusively of this water. Her family consisted of five persons, none of whom, excepting herself and a child, aged four years, ate butter, which was supplied from a farm three miles away, where, it was found, two men were sick with

¹ Journal of the American Medical Association, March 21 and 28, and April 24, 1903.

² New York Medical Journal and Philadelphia Medical Journal, July 11, 1903, p. 70.

typhoid fever. In the summer of the preceding year there had been three cases on the same farm, and in the succeeding summer the owner was seized and did not recover. Five weeks after seeing Case 1, Davidson was called to see another case of the disease in a girl, aged thirteen years, who lived ten miles from Easton, in a family of seven. She was a cousin of the first mentioned, whom she had been visiting five weeks before. Davidson attributes these two cases to butter which was infected by contact with pans washed in water from an infected well. From experiments on the viability of typhoid germs in butter, Bruck¹ concludes that many cases of the disease which are difficult to trace are due to that article of food.

Typhoid Fever from Infected Clothing. Davies² believes that outbreaks of typhoid fever may be due to direct or indirect infection from clothing and bedding, and he refers to two outbreaks which were probably due to this cause. At one station nine to ten cases occurred, and it was shown that these men had been quartered in rooms which had been occupied by convalescents from South Africa. Forty men were accommodated in two rooms; they ate at the same table, the rooms were badly ventilated, and there was a certain amount of overcrowding and other unsanitary conditions. The water supply and drainage and milk were free from suspicion, and he believes that infection occurred through dust in the air.

The Importance of Disinfection of Typhoid Urine. The fact that convalescents from typhoid fever may discharge the specific bacilli in their urine for many weeks is in itself sufficient to call attention to the possible danger therefrom, and to adopt methods for clearing the urine of its infective organisms. Our present knowledge of the bacillus in the urine is summed up by Richardson³ as follows: 1. Typhoid bacilli are present in the urines of about 21 per cent. of individuals afflicted with typhoid fever. 2. The bacilli, when present, are generally in pure culture, and their number is frequently enormous—many millions in each cubic centimetre of urine. 3. The invasion of the urine by the bacilli takes place in the later stages of the disease. Unless measures are taken to remove the organisms they persist frequently for weeks, occasionally for months, and rarely for years, and thus constitute (a) a danger to the patient himself (cystitis and possibly orchitis and epididymitis), and, (b) what is much more important, a grave source of danger to the public health. 4. The necessity for the rigid disinfection and supervision of typhoid urines is apparent. 5. In urotropin we have a drug which will, in the vast majority of cases, remove the

¹ Deutsche med. Wochenschrift, June 25, 1903.

² Journal of the Sanitary Institute, January, 1903, p. 405.

³ British Medical Journal, February 5, 1903.

typhoid organisms from the urine not only in the cases of simple bacilluria, but also in those in which a cystitis has resulted. Very rarely an obstinate cystitis may require the use of vesical irrigations. Very infrequently a case will be seen in which the use of urotropin is followed by hæmaturia. In such cases the drug should be omitted and irrigation of the bladder substituted. 6. This subject in its relation to the public health is of the utmost importance. In my opinion it should be a fixed rule, and one rigorously enforced, that no typhoid convalescent be discharged as well until his urine has been proved permanently free from bacilli. In large hospitals, with their well-equipped laboratories, such supervision can be carried out with ease. Cases in private practice should be under the care of the local boards of health. In this way only can we prevent a considerable percentage of our typhoid convalescents from becoming unsuspected foci for the further distribution of the disease.

Dissemination of Typhoid Fever by Shellfish. Dr. J. T. C. Nash,¹ Medical Officer of Health for Southend-on-Sea, says that prior to 1900 attacks of typhoid fever were ascribed to the commonly accepted causes and occasionally to shellfish. In 1900 investigation developed the fact that in a majority of the reported cases there was a history of having eaten shellfish within two to three weeks of the onset. In the last five months of the following year, in a majority of the reported cases, there was a similar history. Again, during June and July, 1902, in a majority of the thirty-nine reported cases there was a history of having handled or eaten, within a month of the onset, cockles which had been laid in a sewage-polluted creek in another district, in which, during June, nine cases of typhoid fever had occurred. The cockle layings were but a quarter of a mile below an outfall of imperfectly purified sewage. Specimens of the cockles were washed twice in pure water, then plunged into boiling water and withdrawn and subjected to examination, which revealed the presence of living sewage bacteria. Dr. F. J. Allan² stated that he had secured some specimens of cockles supposed to have caused typhoid, and had submitted them for examination at the Jenner Institute of Preventive Medicine, with the result that typhoid bacilli were isolated. Hewlett³ states that samples of cockles from a laying, to which four cases of typhoid were traced, were examined by Klein, who found evidences of the presence of the specific organism. Of eighteen samples of oysters from five different localities examined at the instance of the Worshipful Company of Fishmongers, eleven were found by the same authority to be contaminated by sewage.

¹ Journal of the Sanitary Institute, January, 1903, p. 369.

² Loc. cit.

³ Journal of State Medicine, March, 1903, p. 163.

Klein and Boyce have shown that oysters contaminated by typhoid bacilli can retain their infective properties for two or three weeks, and it is shown that those from sewage-contaminated beds may not be eaten with entire safety until they have lain for about two weeks in unpolluted water. It appears, however, that in cockles the typhoid organism thrives, and that this kind of shellfish is not freed of its infective properties by storage in clean water. Although cockles are not eaten raw, the cooking to which they are subjected is by no means thorough, for boiling for any considerable time makes them tough and uneatable.

The influence of the sewage of a large city is shown by C. A. Fuller,¹ who collected samples of water and shellfish from various places in Narragansett Bay, into which about 14,000,000 gallons of sewage from Providence, Rhode Island, are discharged daily. Water, oysters, clams, and mussels taken at a distance of a quarter of a mile from the sewer outlet, yielded *Bacillus coli communis*, *Bacillus cloacæ*, and *Bacterium lactis aërogenes*. The water and oysters from a bed two miles distant yielded the same organisms. *Bacillus coli communis* was found in 30 per cent. of the oysters, and in 60 per cent. of the samples of water from a bed situated in the line of a strong tidal current, five miles away; and in 40 per cent. of the oysters and 70 per cent. of the water samples from another in sluggish water more than five miles away. One bed six miles distant was found to be contaminated, but those farther down than six and one-half miles were unpolluted.

These findings are in accord with the statement of Dr. E. Klein,² that the nearer to sewer outlets oysters and cockles are planted, the greater the percentage of specimens yielding evidence of pollution. In the examination of oysters he holds that the presence of *Bacillus enteritidis sporogenes* alone is not sufficient proof of recent sewage pollution, but that when the spores of this organism are found together with streptococci and *Bacillus coli communis* they constitute strong evidence of recent contamination.

Dr. Hibbert W. Hill³ has recorded interesting results of examination of clams from flats in the immediate vicinity of the sewer outlets of a number of private dwellings. Attention was devoted solely to the bodies of the clams and not to the water contained between the shell, which was practically the same as that which surrounded them. The technique followed was such as to insure absolutely against contamination by bacteria on the surface, and the portion of the body selected as most likely to show infection was the intestines. The following were isolated and identified: *Bacillus coli communis*, *Bacillus enteritidis*

¹ Science, 1902, No. 375, p. 363.

² British Medical Journal, February 21, 1903.

³ Report of the Board of Health of Boston, Mass., for 1901.

sporogenes, and *Bacillus aërogenes capsulatus* (Welch), all three of which are found commonly in sewage. The typhoid bacillus was not found, and it was unlikely to have been present, since the disease existed at the time in but one of the houses, and the excreta of the patient were disinfected. Dr. Hill adds that the search for typhoid bacilli in sewage known to contain them is, in most cases, practically hopeless, since even in severe epidemics the number of typhoid patients contributing to the sewage is almost always small as compared with the total contributing persons, and only a small proportion of the bacteria present in a typhoid stool are typhoid bacilli; and to hope to find, by examining a few cubic centimetres from a large mass of water, a bacillus which is present in the proportion of one individual to every ten or hundred gallons of water, is almost if not quite useless.

PLAGUE.

Influence of Cold on *B. Pestis*. Exposure to winter weather apparently is more favorable to the virulence and vitality of the plague bacillus than even the more genial temperature of the incubator. Toyama¹ exposed cultures of the organism to the winter cold of Tokio for three months, during which time the temperature observed was four or five degrees below freezing, and they were but little modified, while, at the same time, similar cultures kept at the ordinary incubator temperature were less virulent at the end of the fifty-sixth day, and had lost still more of their virulence at the end of eighty-four days.

Infection from the Soil. The theory that outbreaks of plague are dependent upon infection from soil contaminated with the excreta of rats or other animals is supported by Farrar,² who believes that the element of personal communication in ordinary non-pneumonic cases is a factor of small importance, the infection being ordinarily the result of direct inoculation from the soil. In favor of this view are: 1. The localizing tendency of plague. Thus, plague is endemic in certain districts, notably in the Kumaon districts and in Yunnan. In Kumaon, of two villages but little more than a quarter of a mile apart, one may be visited by an epidemic and the other may remain absolutely exempt. 2. The efficacy of abandonment of a location in checking the spread of outbreaks. This is shown by the fact that sporadic cases occurring in camps of people from an abandoned district are almost without exception in persons who have made visits to their homes contrary to orders. 3. The lack of conclusive evidence that the disease is conveyed by

¹ *Centralblatt f. Bakteriologie, etc.*, 1902, vol. xxxii., No. 3, p. 181.

² *British Medical Journal*, August 16, 1902.

direct contact. In India and elsewhere, where the population go largely barefoot and are, therefore, subject to abrasions of the skin of their feet, infection is easy; and where the disease occurs the rate of attack is high. The terrible susceptibility of the Indian population is accountable by the fact that they are, as a rule, a barefooted people, the majority of whom wear toe-rings, which cause chronic abrasions of the skin; and that the women scour their utensils by hand, using earth as a scouring agent, and sweep the floor with the bare hands. Persons who are well clothed and well shod have but little to fear from plague. The notion that plague infection enters the body exclusively through abrasions is combated by Deane,¹ who concludes that careful examination shows that no greater proportion of the natives show cuts or abrasions than may be shown in any large community. In a small proportion of cases skin lesions are observed, which, although when they appear early in the course of the disease may seem to point to a place of entrance for the virus, are quite as likely to be manifestations of the general blood infection. Deane believes that the disease is contracted by inhalation.

Plague and Rats. The remarkable susceptibility of rats to plague needs now no further proof. It has been shown that they acquire the infection from eating the victims of the disease, and may thus spread the infection. According to Lydston,² the first case in the epidemic of plague in Sydney, New South Wales, in 1902, was preceded by an epizootic epidemic among rats, which proved to be plague, and it was shown by many experiments that the flea was the probable agent of infection. A case of direct transmission of plague from rat to man is mentioned by Calvert,³ who states that when in Hong Kong he was told of a Chinaman who found a sick rat in a hydrant, and who, while trying to kill the animal, was bitten in the left thumb. Several days later he developed a fatal case of plague, with a left axillary primary bubo. But rats are neither a necessary precursor nor a concomitant of attacks of plague, for epidemics have been observed in which rats played no rôle whatever. Nevertheless, it is advised by Olschanetsky⁴ that rats be prevented from having access to ships, especially those having the disease aboard, for they probably play an important part in the propagation of the disease.

According to W. Hanna,⁵ rats are found in greatest numbers on board ships carrying wheat, corn, oilcake, aniseed, and other articles in the cargo; ships carrying salt and nitre are found commonly to be

¹ Indian Medical Gazette, Calcutta, March, 1903.

² New York Medical Journal, February 28, 1903.

³ American Medicine, January 24, 1903, p. 143.

⁴ La médecine moderne, August 13, 1902.

⁵ Journal of the Sanitary Institute, January, 1903, p. 716.

free from rats. In Hanna's opinion the routine practice of fumigation for the destruction of rats, such as is carried out at Hamburg, is pretty nearly impracticable. At Hamburg all foreign ships and those from the Mediterranean are fumigated every voyage, and those from other European countries every three months. In the matter of methods for the extermination of rats, first to be considered is the berthing of ships at a suitable distance from the wharf by means of lighters and fenders. The berthing regulations are not really effective, because rats cannot be prevented from leaving the ship if they wish to. They can board lighters, climb up rough stonework or chains, and even jump long distances. They can swim considerable distances, and ultimately gain a foothold on the dock wall. Experiments have been made at Liverpool on the efficacy of the various rat guards, such as tin disks, brushes, etc., and experience has shown that they cannot be entirely relied upon in preventing rats from leaving a ship. The disks are twenty-seven inches to thirty inches in diameter, and this is as large as can be conveniently used. Tar on the ropes has been tried as an obstacle, but it has been found absolutely useless. In destroying them cats cannot be employed, because these animals readily contract plague. The mongoose might be tried more generally, but no promising reports have been received as to their clearing ships of rats. Poison is a ready means, but the putrefying bodies are a nuisance. Trapping does very well, but can be carried out effectively only by experienced and reliable rat-catchers. The employment of the Danysz bacillus has given uncertain results in the hands of many experimenters. In the employment of fumigation the gases advocated are carbon monoxide and sulphur dioxide. With the former, a mixture containing 1.5 per cent. with air is passed into the holds. It has no smell, has no action on the ship's fittings, and it does not alarm the rats, but it stupefies and kills them. Naturally it must be used with great caution, on account of its extremely poisonous character. In the matter of odor it has a great advantage over the sulphur gas, for rats will not venture where there is the least smell of sulphur dioxide; but they are easily killed by burning two pounds of sulphur to every 1000 cubic feet. This gas has been employed for years in the South American grain ships to clear them of rats. It is not necessary to burn sulphur in the holds, because, nowadays, with improved methods, the gas can be more conveniently pumped from a barge.

One disadvantage of carbon monoxide is that the rats die in their holes and in the skins of the ship. This is not the case with sulphur dioxide, which irritates the throat and mucous membranes and causes the rats to rush out and try to get to the fresh air. They seek the hatches, and if they cannot get out they die there, their bodies being

found, as a rule, lying nearby. If the machinery exposed to the gas is perfectly well oiled or vaselined no harm is caused.

The burning of small quantities of sulphur at frequent intervals in the hold of vessels and in other places frequented by rats on board ship, so as to have a slight taint in the air, will do much to prevent rats from remaining on board.

In destroying rats, Blackmore¹ finds dogs and cats useful but unreliable auxiliaries, and he especially cautions against the use of ferrets, which themselves become easily infected, and hence a possible means of spreading the disease. From consideration of the various methods employed in the destruction of rats he believes that poisoning leads to the best results.

During the epidemic plague in Manila, lasting from December 26, 1899, to March 6, 1902, active war was waged against rats, a body of natives having been organized for the purpose. According to the *Philadelphia Medical Journal*, January 17, 1903, the efforts of this body of men, reinforced by a fee of five cents Mexican for each rat sent to the government laboratory by persons not of the regular rat-catching corps, resulted in the catching alive of 50,000 rats and in the destruction of several hundred thousand by poison. Each squad of rat-killers was furnished one hundred ratsbane tins and receptacles for carrying the same, a galvanized iron bucket of a disinfecting solution, and another bucket for carrying the dead rats. The squads went on duty at 8 P.M. daily and distributed the poison throughout the entire city. Not later than 5.30 the next morning the morning squad began their rounds, removing the poison and collecting the dead rats on the premises visited. The dead rats were disinfected, tagged, and turned over to the laboratory. Of more than 40,000 rats examined microscopically for plague bacilli, only 242 were found to be infected.

Among the poisons employed successfully were prepared cheese with ratsbane; a mixture of ground glass, flour, cornmeal, and syrup, with 1 per cent. of strychnine; ground rusty bacon, or boiled rice, with 60 per cent. of arsenious acid; and a mixture of equal parts of flour and plaster of Paris, with a dish of water alongside.

Since all the rats sent to the laboratory to be examined were tagged, it was possible to trace the infected ones to the houses where they were caught, and all such houses were treated as if the inmates had been infected with the disease.

Infection Through Rat Fleas. Notes of an outbreak of plague at Port Elizabeth, South Africa, showing the connection of rats with the spread of the disease, are contributed by Blackmore,² who found that

¹ *Lancet*, October 11, 1902.

² *Ibid.*

at places where infected rats were found the disease followed, while at places where no infected rats were found only four cases occurred, and in these cases it was not possible to ascertain the origin of the infection. There was no evidence whatever of man-to-man infection. He points out that the disease is probably communicated to man by some intermediary between man and rats, and he concludes that this intermediary is the rat flea, which insect leaves the dead rat as soon as the body becomes cold. It has been stated that the rat flea will not bite human beings, but the statement has not been proved. The fact that it does not always is no proof that it does not sometimes bite man, though probably, like the fleas that are peculiar to dogs, cats, and other animals, they are not attracted to man. He suggests also that plague may be transmitted from man to man through the agency of the flea which infests man. That plague can be transmitted by fleas seems not so improbable as it did when it was stated by Galli-Valerio that the fleas that infest rats are not the species that attack man. Gauthier¹ found that the disease is certainly transmitted from rat to rat by fleas, and that the fleas which he obtained from rats will bite human beings. The question has been investigated also by Tidswell,² who examined one hundred fleas taken from rats during the recent epidemic of plague in Australia. These were found to be chiefly *Pulex pallidum* (eighty-one); ten were *Pulex asciatus*; one was *Pulex serraticeps*; and eight were *Typhlopsylla musculi*. All of these four species, excepting the last mentioned, were found to attack man.

SMALLPOX.

Of very great importance to the study of the unknown causes of the exanthemata is the discovery by Drs. Councilman, Magrath, and Brinkerhoff of the probable parasite of smallpox, announced at a meeting of the Boston Society of Medical Sciences on April 28, 1903. From their preliminary communication³ the following is taken without abridgment:

"In the lower layers of the epithelial cells of the skin, before there is any anatomical evidence of vesicle formation, there are found small, structureless bodies, from one to four microns in diameter. The epithelial cells at this time present little or no evidence of degeneration. The bodies, one or more in number, lie in vacuoles in the cells. The vacuoles are at first but little larger than the enclosed bodies. The bodies increase in size, and evidence of structure, consisting of granules

¹ Bulletin de l'Académie de Médecine, December 16, 1902.

² British Medical Journal, June 23, 1903.

³ Journal of Medical Research, May, 1903, p. 372.

more distinctly stained and lying in definite spaces, begins to appear. With the increase in size of the body the vacuole of the cell enlarges until a large central space around the nucleus is formed. At this time there is but little evidence of degeneration of the nucleus. The body continues to increase and becomes granular, the granules lying in a reticular structure. The form of the larger bodies is irregular and suggests an amoeboid character. They may become as large as or larger than the nucleus of an epithelial cell. A definite nucleus has not been made out in them, unless the reticular structure which stains more intensely than the rest of the body be so considered. At this time segmentation takes place, leading to the formation of small, round bodies about one micron in diameter. All this is best seen in the acute hemorrhagic cases. It may also be seen in the advancing edge of a young vesicle, the bodies becoming larger and more definite in structure as the formation of the vesicle advances. The bodies in the cells we regard as living organisms, and the gradual growth and final segmentation as a cycle in its life history. Up to this time the nuclei, although showing such evidences of degeneration as the massing of chromatin in the periphery, are not greatly altered.

"At the period of segmentation, and when most of the intracellular bodies have disappeared, small round or oval, ring-like bodies appear in the nucleus. These increase in size and acquire a definite structure, consisting of a series of vacuoles around a large central vacuole. The rim of the central vacuole stains more distinctly than do other parts of the body. One or more of these bodies may appear in a single nucleus. When several are present they are smaller, but have the same structure. The bodies become larger, the nuclear rim grows less distinct and finally disappears, and the body lies in a completely degenerated cell, or this breaks down, setting free the body. With the growth and development of the intranuclear body the vacuolar structure becomes less evident, and, finally, a structure is formed which contains numerous fine vacuoles. At this time small, circular bodies begin to appear in it, and groups of these are surrounded by a faint ring, which probably represents the remains of the body in which they were formed. The circular, ring-like bodies have a central dot. They are one to one and one-half microns in diameter, and are seen with great difficulty. They were first found in a photograph of the tissue. Single ones and clumps are also found.

"We regard this intranuclear body as a further stage of development of the intracellular body, and as representing a second complete cycle of development. It develops from the spore-like bodies produced by the segmentation of the intracellular body, which pass into the nucleus. The spores which are formed from its segmentation we consider the

true infecting material of variola. In a case of hemorrhagic smallpox we have found bodies similar to these spores in a bloodvessel of the skin.

"In vaccination of the rabbit and calf, Dr. Tyzzer, who has been following this line of investigation, has found bodies similar to those met with in the first cycle of the smallpox organism. The complete cycle of this organism, which corresponds to the primary cycle of the smallpox organism, has been traced. Dr. Tyzzer has never found any of the *intranuclear* forms. The inoculation of the rabbit with contents of variola pustules gives rise to bodies similar to those in vaccinia and in the first cycle of variola. Here, also, it has not been possible to follow the complete cycle. The *intranuclear* forms have not been found, although carefully sought for. Inoculation of the monkey with contents of variola pustules produces lesions which we must regard as variola, and in these the *intracellular* and the *intranuclear* cycles are found, occurring in the same sequence as in man. From this we regard it as extremely probable that in smallpox the complete development of the parasite through two cycles takes place, and that in vaccinia the primary cycle only. Definite conclusions on this, however, can be reached only by further study of vaccinia in animals subject both to vaccinia and to variola. The variola spore in such an animal as the calf finds conditions which allow of the development of the primary cycle only. The spore-like body which is formed in this cycle when introduced into an unprotected human being goes through the same development, producing vaccinia.

"In variola the entire process of development of the parasite is concluded with the formation of the young vesicle. The spores are present in the contents of the vesicle and of the pustule, but their recognition among the detritus of cells and exudation is impossible unless differential methods of staining them shall be discovered. We have also seen forms of the intranuclear bodies which seem to show that the intranuclear cycle is sexual in character."

MALARIA.

In a recent communication on the campaign against malaria, Koch¹ states that when he turned his attention to that disease he was very soon convinced that it was a simple matter to seek out the sources of the infection and destroy it with quinine. The malarial parasite is evidently not to be found elsewhere than in the human system and the anopheles mosquitoes; if it were to be found not only in human blood

¹ Zeitschrift f. Hygiene, May 22, 1903, xliii., p. 1.

but in the blood of other animals, it would be practically impossible to root out the disease by any simple means. Having this in mind, he intentionally restricted the work in an experiment in Stephansort to finding the parasites in man and destroying them, and found it possible to eradicate malaria almost wholly, which demonstrates that the parasite is, in fact, an obligate parasite of man. A similar experiment was conducted by Frosch¹ in the islands of Brioni, and the work was carried out so thoroughly and carefully that the disease was completely eradicated from a locality which formerly had suffered very severely. At the same time another experiment was conducted by Bludau² at Punta Croce, on the island of Cherso, and another by Vagades³ in Franzfontein, in German Southwest Africa. All of them gave most interesting results. The inhabitants were sought out and examined for parasites, which, if present, were destroyed by continuous and prolonged use of quinine, without attempting to carry on a special campaign against the anopheles mosquitoes; for if these cannot obtain the infective material from human beings on whom they feed, they cannot themselves originate the parasite and spread the disease. In Brioni, at the end of two years, the disease was eradicated. Prior to the campaign, whoever settled in Brioni, or even came for a short visit during the fever season, became a victim to the disease, and this dangerous condition had always existed; but now it is changed, for in this very short time—for the first time in the memory of man—not one but 170 men came to the island free of the fever, and remained over a year earning their daily bread in comfort and without a seizure. Bludau had equal success with his work at Punta Croce, where the disease was found chiefly among children, of whom there were forty-two in the village. Only four of them failed to show the parasite in their blood. At Franzfontein, in German Southwest Africa, the first examination showed malarial parasites in 68 per cent. of the natives. Later examinations showed it in 75 per cent., and in from 28 to 71 per cent. of the tribes in the surrounding settlements. After proceeding on Koch's lines the result was a complete success. During the following year only fifteen cases of malaria occurred, and four of these were importations.

How cases of malaria may occur in winter among persons with no malarial history is shown by Jancsó,⁴ who relates that during winter weather, with ice and snow on the ground, nine cases of malaria occurred in a hospital among the patients and attendants. Clinically and microscopically it was determined that each case was of the estivo-autumnal malaria. Some time before the outbreak about twenty laboratory anopheles that had been infected with the estivo-autumnal parasite

¹ Zeitschrift f. Hygiene, May 22, 1903, xliii. p. 5.

² Ibid., p. 67.

³ Ibid., p. 83.

⁴ Deutsche Archiv f. klin. Medicin, lxxvi. p. 474.

escaped from their cage and made their way to the wards, where they bit a number of patients and attendants. Later they were caught and examined microscopically and found to show the sporozoites.

YELLOW FEVER.

The Yellow Fever Parasite. The most important advance made in the study of the etiology of yellow fever is the discovery of a protozoon in mosquitoes (*Stegomyia fasciata*) that were allowed to bite persons with the disease. This important discovery was made by Working Party No. 1 of the Yellow Fever Institute of the Public Health and Marine Hospital Service, consisting of Drs. Herman B. Parker, George E. Beyer, and O. L. Pothier, whose report¹ of their investigations, which were conducted at Vera Cruz, Mexico, contains the following conclusions: 1. The bacteriological examination of the blood of cases of yellow fever during life and of the blood and organs at autopsy performed immediately after death in uncomplicated cases is negative. 2. *Stegomyia fasciata*, contaminated by feeding on a case of yellow fever forty-one and one-half hours after the onset of the disease, and subsequently fed on sugar and water for twenty-two days one and one-half hours, can, when permitted to feed on a non-immune individual, produce a severe attack of the disease. 3. *Stegomyia fasciata*, contaminated by feeding on a case of yellow fever and after varying periods killed, sectioned, and appropriately stained, presents with regularity a protozoon parasite, the *Myxococcidium stegomyia*, that can be traced through a cycle of development from the gamete to the sporozoite. 4. *Stegomyia fasciata* fed on blood from a case of malarial fever, on normal blood, or artificially fed, does not harbor the parasite indicated in conclusion 3.

Agramonte² finds that the bodies found in the blood of yellow fever patients and supposed to be the parasite of the disease can be recognized only after considerable practice. They are globular, hyaline bodies, found in the plasma, and do not possess motility. They contain minute granules which seem to be in constant, rapid motion. These bodies are not mentioned in the report of Working Party No. 1 referred to above.

Concerning the length of life of the yellow fever mosquito, Guitéras³ reports the following experiment: Eighteen mosquitoes, hatched on August 1, 1902, were made to bite, four days afterward, a person suffering with yellow fever. Seven were killed in order that the intestinal and salivary glands might be studied, and the remainder were allowed

¹ Bulletin No. 13, Yellow Fever Institute, Washington, 1903.

² Revista de medicina tropical, October 15, 1902.

³ Ibid., April, 1903.

to live in order to determine their longevity. They died in from five to one hundred and fifty-four days.

In an article on "The Transmission of Yellow Fever," by Dr. James Carroll,¹ attention is called to the fact that a number of American observers have noted the large numbers of mosquitoes present during outbreaks of yellow fever, among them Rush in 1837, Weightman in 1839, Wood in 1853, Barton in 1853, and Beyrenheidt in 1853. According to the report of Working Party No. 1 of the Yellow Fever Institute, there are no *stegomyia* at El Palmar, about eight miles from Carasol, Mexico, where yellow fever was epidemic as soon as the mosquitoes were introduced, and although cases of the disease were sent there no additional seizures occurred. Cases were sent also to Jalapa, where, no *stegomyia* existing, the disease failed to spread.

The Question of Fomites vs. Mosquitoes. While the agency of *Stegomyia fasciata* in the causation of the disease is generally accepted, not all sanitarians have accepted the findings of the Army Yellow Fever Commission with regard to the harmlessness of fomites. According to Chaillé,² the only advocates of fomites who have published their views are two distinguished sanitarians having wide knowledge and experience in yellow fever, namely, Dr. John H. Purnell, of Mississippi, and Dr. Edmond Souchon, President of the Louisiana State Board of Health. He has summarized their arguments to prove that the mosquito is not the sole distributing agent, but that fomites must also be considered. The following are some of the points brought out:

1. It is claimed that the freedom of Havana from yellow fever in 1901 and 1902 was due to the exclusion of imported cases and to the dying out of the disease rather than to the warfare on mosquitoes, and there is evidence that other Cuban cities escaped the disease without active measures against these pests. There are good reasons to believe that in these places any cases that did occur were isolated, and access to them was prevented. Moreover, these cities had but few non-immune inhabitants. It is true of yellow fever as of other diseases that sometimes it tends to die out in spite of the coexistence of some cases and of many immunes. The cause of this tendency may be a scarcity of the specific mosquitoes in some years. However, in spite of this tendency, it has never shown itself in Havana in a period of one hundred and forty years to an extent to be compared with the remarkable cessation of the disease since measures were taken against mosquitoes.

2. The frequent return or recrudescence of yellow fever six, twelve, or more months after a cold winter, and without the reintroduction of

¹ Journal of the American Medical Association, May 23, 1903, p. 1429.

² Ibid., May 23, 1903, p. 1433.

the infection, is incompatible with our present knowledge of the duration of life of the stegomyia, which thus far has lived not longer than one hundred and fifty-four days (Guitéras). The example of recrudescence cited most often, and cited recently by the two gentlemen above mentioned, is criticised by Chaillé. In this instance, which was reported by Dr. G. B. Thornton, President of the Memphis Board of Health, the first case was attacked about the 5th, was reported on the 8th, and died on the 9th of July, 1879, when yellow fever did not then prevail in any part of the United States. This led to the conclusion that the disease was due to "local origin;" that is, to houses and their contents infected in 1878—that is to say, to the recrudescence of the dormant vitality of infected fomites. Chaillé shows now, for the first time in this connection, the following facts: Dr. Coleman, an inspector of the National Board of Health, maintained that the disease was due to two box cars of bananas from the West Indies via Havana and New Orleans, that arrived in Memphis prior to July 4, 1879. More important, while it was true that yellow fever was not "prevailing" anywhere in the United States, it did exist in New Orleans, as shown by the *Annual Report of the Louisiana State Board of Health for 1879*, in which are recorded three cases—one imported case on March 26th and two home cases on June 16th and 17th. Thus there was sufficient time for the transportation of the specific mosquitoes from New Orleans to Memphis to infect the first case reported in Memphis. The alleged recrudescence might have been due to mosquitoes and not to fomites. Furthermore, it is an indisputable fact that the first cases reported in New Orleans have often not been the first that have occurred. Thus the case of the stegomyia becomes still stronger.

3. In behalf of fomites it has been urged that non-immunes in camps of refuge infested by mosquitoes and near infected cities have been kept free from infection by the destruction or disinfection of fomites, but such cases of the disease as were imported were usually promptly isolated; and while there may have been swarms of mosquitoes, there may have been none of the essential species, for the stegomyia is more likely to prefer houses and to shun the country and open fields, and there may have been stegomyia, but none infected. Further, New Orleans could furnish many instances of failure to increase the number of cases of yellow fever through the presence of neglected fomites, which would suggest the absence of infected mosquitoes. The comparative exemption of New Orleans in 1882, when there were only four deaths reported, was claimed to be due to the thorough cleansing and disinfection of the section surrounding the focus of infection "for at least four blocks each way around the focus."

In this and another similar instance sulphur fumigations were vigor-

ously applied, the very remedy especially recommended to destroy *stegomyia* mosquitoes.

4. Reported cases of two kinds have been urged as explicable by fomites, but not by mosquitoes. Some cases have been reported where the possible infection of the mosquitoes and the transfer of the infection to the person attacked gave intervals of less than the least interval of twelve days found in the twenty experimental cases of the Army Yellow Fever Commission; but a larger number of experimental cases might have proved the possibility of a shorter interval than twelve days, and, furthermore, it is possible that the intervals stated—eight, nine, and ten days—were not correct. Numerous other cases are reported to have followed exposure to fomites under such conditions that the presence of infected mosquitoes was highly improbable, if not impossible. In some of these the disease was limited to the few non-immunes exposed to the fomites, while other non-immunes in the same house were not attacked. In such cases it is notable and suspicious that even the fomites from those attacked failed to infect the other non-immunes in the same house. But all of these cases are subject to the criticism that there may have been a mistake in the diagnosis, for many cases in adults and many more in negroes and children cannot be diagnosed by the best of experts.

During the quarantine season of 1902, according to Souchon,¹ fruit vessels plying between New Orleans and Central America carried inspectors, who were instructed to capture on each vessel a number of mosquitoes in order to determine their species. Twelve of these vessels made about one hundred and eighty trips during the season, and their inspectors captured 208 specimens and sent them to the Division of Entomology in Washington for inspection, which showed that five—that is to say, less than 2.5 per cent.—were *Stegomyia fasciata*. The fruit vessels plying between New Orleans and Havana during the quarantine season furnished seventy-one mosquitoes, of which ten, or about 14 per cent., were *stegomyia*. During fifteen years there were about twelve hundred and sixty arrivals of fruit vessels at New Orleans from tropical ports, and during this time five arrived from infected ports, with yellow fever on board, during the quarantine season. The percentage of arrivals with the disease on board is, therefore, about two-fifths of one per cent. In ten years ending 1895 nearly one thousand fruit vessels came to the wharves at New Orleans, and about fifty laborers were permitted to board each fruit vessel freely for about five hours, which is the time required to unload a fruit vessel, and during these ten years not a case of yellow fever originated in New Orleans.

¹ Journal of the American Medical Association, June 13, 1903.

That the stegomyias on fruit vessels are not infected he considers proved by the fact that in fifteen years there was but one case of yellow fever stopped at the quarantine station during the quarantine season that could not be traced directly to the shore; and that, in spite of the free intercourse of laborers with the fruit vessels before fumigation, not a single case of yellow fever originated in New Orleans in ten years; that is to say, during ten years there were practically 50,000 exposures of five hours each to mosquitoes prior to disinfection of the holds, without a case of yellow fever originating.

He regards it as improbable that stegomyia on infected fruit vessels will become infected before arrival at the quarantine station. The percentage of vessels infested with stegomyia is, as has been shown, but small—2.5 per cent.; the females must be impregnated before they will bite; the males are in very small number on board; the females must bite a sick person within the first three days, and cannot infect a human being until twelve days thereafter, and after once biting do not appear to bite a second time for about a week. They do not breed in bilge water nor in sea water. He states, further, that it is impossible for mosquitoes on an infected fruit vessel to carry yellow fever to the city, because the vessels are not more than six days in transit before reaching the quarantine station, where all suspected and infected vessels are thoroughly disinfected, so that all the mosquitoes are killed before they have become capable of transmitting the disease (twelve days). Almost all the new cases of yellow fever found on fruit vessels are shown to have had communication with the shore, with one exception, and in that case it is doubtful.

An interesting examination of vessels arriving at the gulf quarantine station has been conducted by S. B. Grubbs.¹ This station is ten miles from land, and vessels inward bound do not pass near the land, and so rarely take on mosquitoes on the way. Between June 1st and November 1, 1902, eighty-two vessels arriving from ports where stegomyia are present were examined. These included four steamships and seventy-eight sailing vessels. All but seventeen were said to have been free from mosquitoes at all times during the voyage, and none was found on examination. Of five that had them on board on sailing, two got rid of them as soon as out to sea, and three carried them two days only; but one of the latter was troubled again five days before she arrived and when she was twenty miles from land. On nine sailing vessels that had none on board on sailing they appeared late in one case from the water casks, in which the captain found larvæ. In none of these nine were any anopheles or stegomyia found. The mosquitoes

were culices that came aboard when the vessels were distant from land two miles (two), ten miles (one), fifteen miles (three), and twenty miles (one). The yellow fever mosquito was found in three ships. The three ships were from Vera Cruz, Mexico—the schooner *Susie B. Dantzier*, fifteen days out; the schooner *Eleanor*, thirteen days out, and the brigantine *John H. Crandon*, twenty-two days out. All three of these vessels took on the mosquitoes at Vera Cruz. The first two mentioned lay off shore one-half mile. No larvæ were found in the tanks of either. The last-mentioned also lay one-half mile off shore and three-eighths of a mile from an infected prison, but within two hundred yards of an infected vessel. She had an abundance of mosquitoes all the way, and they amounted to a plague on arrival. The tanks were infested with larvæ, and there was a constant buzz of the insects in the forecastle.

The Cuban Government enforces the following regulations for vessels from yellow fever ports of Mexico and elsewhere:¹ It maintains resident medical inspectors at Progreso, Vera Cruz, and Tampico, who issue certificates of immunity to passengers who have had yellow fever or who have lived ten years in an endemic focus of yellow fever. They burn pyrethrum powder in the holds of vessels, and place a guard on board to prevent anyone going ashore except the captain, and anyone from going aboard except the laborers. All the regulations are based on the mosquito principle, and no attention whatever is paid to fomites on the vessels or at the yellow fever hospitals. None of the vessels coming from Mexican ports has Havana for a final destination, being all in transit to some other port, excepting the cattle vessels, which go back immediately. The vessels which anchor away from the wharf at Havana and have no passengers to land are not disinfected, but a guard is placed on board until they are ready to proceed elsewhere. If the vessels carry passengers, those having certificates of immunity are set free at once, while those who have no such certificates are detained. Vessels which have come to the wharf at the Mexican ports or have had communication with any other suspected or infected craft are considered infected. If they have no passengers they are not disinfected, but a guard is placed on board until they leave. If they have passengers the immunes are set free and the non-immunes are detained for five days from the day of arrival.

If a case of yellow fever arrives at Havana on a transient vessel, it is taken directly to the hospital, and the immune passengers are set free. The non-immunes are detained for five days, the vessel is disinfected for mosquitoes with formaldehyde or sulphur, and a guard is placed on

¹ Public Health Reports, Washington, July 3, 1903.

board until she is ready to depart. Immunes are never detained under any circumstances, even though coming on actually infected vessels, being permitted to go free. No vessel is disinfected unless it has had a case of yellow fever on board.

It has been demonstrated repeatedly that mosquitoes confined in trunks, boxes, or bags of clothing cannot survive longer than four days because of the absence of water.

ANKYLOSTOMIASIS, UNCINARIASIS, HOOKWORM DISEASE.

An editorial in the *Journal of the American Medical Association* of January 3, 1903, calls attention to the fact that a little more than a year before, it had been editorially stated¹ that ankylostomiasis was apparently a rare affection in the United States, which view, in the face of numerous cases which have been observed, must be modified, observations having led to the discovery that the disease is extremely prevalent among the poorer classes of the Southern whites. In a preliminary report by Dr. Charles Wardell Stiles² to the Surgeon-General of the Public Health and Marine Hospital Service he states that he met the hookworm disease, uncinariasis, in the Virginia copper mine district of Southern Virginia and Northern North Carolina, and had then traced it through the coal mine district of Cumnock, N. C., the brick yards of Camden, S. C., and the granite sand district of Lancaster and Kershaw counties, S. C. The indications were that the disease is more prevalent in sandy regions than in clay or stone districts. On farms and plantations in the sand district it appeared to be the most common disease of man, and from an economical point of view to be of great importance. The extreme cases were more commonly among children and women than among adult males over twenty-five years. Facts at his disposal indicated that the malady is not so fatal as the European form of the disease caused by *uncinaria duodenalis*. The cases examined were found to be due to *uncinaria americana*, which shows that it is an endemic infection quite independent of cases which have been introduced from Europe, Asia, and Northern Africa. The heavy and frequent infections found are amply explained by the almost total absence of privies and closets on the farms visited. In consequence of the habits of the people the premises become heavily infested with the embryos. In the mines the infection so far as discovered is less severe and less common than on the farms and plantations of the sand district. In Stiles' opinion, uncinariasis is one of the most impor-

¹ *Journal of the American Medical Association*, November 30, 1901, p. 1466.

² *Public Health Reports*, October 24, 1902.

tant and common diseases of the South, and to it is largely due much of the trouble popularly attributed to dirt-eating, resin-chewing, and even some of the proverbial laziness of the poorer classes of the white population.

That the disease is the most common of the serious diseases of the Southern States is attested also by Harris,¹ who states that in June, 1902, he made a trip through Northern Georgia, a region that long has been noted as one in which the inhabitants are very pale and anæmic, and here he found many instances of the disease. During September and October he studied malaria in Southern Georgia and Florida, in a region in which the profound anæmia is commonly ascribed to malaria; but he found that in almost all instances the sufferers had no malarial parasites in their blood, but did have the ova of the hookworm constantly in the fecal discharges. Harris says that he feels no hesitation in stating that time will show that by far the greatest number of cases of anæmia in Georgia, Florida, and Alabama are not due to malaria, but to uncinariasis, and that this is the most common of all the serious diseases of that part of the country. Probably what is true as regards the States named likewise holds good for the entire South. In Alabama, Bondurant² met his first case of hookworm disease early in 1903, and this was followed by other cases; and having interested a number of professional friends in the study of the disease, many specimens of bowel discharge were submitted to him for microscopic examination, which revealed the ova in about fifty cases from Mobile and neighboring counties in Alabama and two from other States. Others in Alabama have reported to him twenty, thirty, one hundred or more, and varying numbers of cases. He states that he feels justified in asserting that every physician in Alabama whose practice extends into the country and among the poorer class of whites has seen not a few, but many, cases of the disease, and that there is good reason for the belief that it is one of the most widely prevalent and most serious diseases with which the poor classes of whites have to contend. Of course, every person suffering from the disease is a source of serious and constant danger to others, since soil, water, and some kinds of vegetable food are sure to become infected by the many millions of hookworm embryos which the sufferer casts abroad. The dirt-eaters of the sand hills, he says, "are excellent examples of the disease, and anyone who can recall the appearance and mental characteristics of a little, stupid, tallow-faced, dirt-eating boy has a typical picture of uncinariasis." Persons who work in earth, such as farmers, brickmakers, and miners, and children who play in the dirt, go bare-

¹ American Medicine, November 15, 1902.

² New York Medical Journal and Philadelphia Medical Journal, July 4, 1903, p. 8.

footed, and eat with soiled hands, are particularly endangered. The disease is never met with in cities or towns having a clean water supply and a system of sewage disposal. Not one of the cases which have come to the knowledge of Bondurant originated in the city of Mobile.

Many cases which hitherto have been assumed to be malarial cachexia are, according to Agramonte,¹ cases of true ankylostomiasis. In sixteen cases of progressive anæmia, twelve of which had been diagnosed as malarial cachexia and three as splenic anæmia, he found the parasite. A recent outbreak of anæmia which occurred in the Dolcoath mine, in Cornwall, has been attributed² to ankylostomiasis, which spreads in the mines through the unsanitary method of disposing of excrement, or, better, of not disposing of it. The ova are carried therein on boots to the ladders, and thence to the hands, and finally to the mouths of the miners, many of whom have worked in foreign mines and probably introduced the parasites. According to a note in the *Journal of the American Medical Association* of January 24, 1903, the number of cases of ankylostomiasis in the Bochum district in Germany increased from 286 in 1900 to 1029 in 1901. Attempts to disinfect the running water in the mines have been unsuccessful or else have obstructed the pipes. All sanitary precautions meet with passive resistance on the part of the miners.

The geographical limits of ankylostomiasis, according to Baker,³ extend to 50° north latitude and 30° south latitude, thus covering a large part of the north temperate zone as well as the tropics. He questions the possibility that the parasite can enter in the hair follicles of the skin, and holds that there is ample reason for the prevalence of the disease in the habits of the natives of the countries where it prevails, for they live under the most unsanitary conditions, are filthy in their habits, eat with dirty hands, and practice dirt-eating. The theory of water-borne infection must be abandoned, for the embryos cannot live in water.

EPIDEMIC DIARRHŒA.

The causes and treatment of epidemic diarrhœa, a disorder that causes very great mortality in Italy, have been investigated by Valagressa,⁴ who found uniformly on bacteriological examination of the evacuations a bacillus of the *B. coli* group, different varieties of which he regards as responsible for every case. The toxin of the organisms isolated proved, when inoculated into animals, to be capable of causing vomiting, diar-

¹ *Revista Medica Cubana*, vol. i., No. 4.

² *British Medical Journal*, March 28, 1903.

³ *Annali d'igiene sperimentale*, x., No. 4.

⁴ *Lancet*, December 27, 1902.

rhœa with tenesmus, anorexia, hyperæmia of the intestinal mucosa, with punctiform hemorrhages in the lower part of the ileum and in the vicinity of the cæcum, and amyloid degeneration of the liver. Thus the symptoms and post-mortem appearances in typical cases of the disease and in inoculation experiments are practically the same.

The bacterial flora of a number of cases of summer diarrhœa in infants has been studied by Duval and Bassett,¹ who in forty-two typical cases succeeded in isolating the Shiga bacillus of dysentery. They secured the specific organism also from scrapings of the intestinal mucosa at autopsy, and in one case from the mesenteric glands and liver. In the stools of acute cases the organism was often present in large numbers, but in those of mild cases and those of long duration it was secured with difficulty, because of its presence in relatively small numbers and also because of the antagonism of the normal intestinal bacteria. The specific bacilli isolated from different cases proved to be identical, and to agree in all ways with those isolated from cases of acute dysentery in adults by Shiga in Japan, Flexner and Strong in the Philippines, Kruse in Germany, and Vedder and Duval in this country. It was not found in the stools of twenty-five healthy children nor in those of simple diarrhœa, marasmus, and malnutrition. Agglutinative reactions were obtained when the organisms were tested with (1) blood serum of patients from whom they were secured, (2) the serum of other infants suffering with summer diarrhœa, (3) the serum of adult patients with acute dysentery, and (4) with antidysenteric immune serum, but not with the blood serum of healthy children. They conclude that the summer diarrhœa of infants is etiologically identical with the acute bacillary dysentery of adults.

In an epidemic of diarrhœa which occurred during the summer of 1902 at a seashore resort on the coast of Maine the Shiga bacillus was found by Strong² in four cases. The outbreak was the third from which the community had suffered in three successive years, and, as in the previous years, it involved both adults and infants. Water, milk, and general food supply could not be suspected in any way, but Strong believes that "although definite conclusions are not justified from the fragmentary and inexact nature of the evidence afforded by these cases, the facts at least suggest that there must have been a common cause for a certain proportion of the unusual number of diarrhœas encountered."

¹ Centralblatt f. Bakteriologie, etc., December 22, 1902, p. 52.

² Boston Medical and Surgical Journal, March 26, 1903, p. 331.

PRACTICAL THERAPEUTIC REFERENDUM.

By H. R. M. LANDIS, M.D.

Acetozone. The employment of acetozone has gradually increased since its first introduction into medicine, and the testimony of those who have used it most would indicate that it possesses marked germicidal activity.

PROGRESSIVE MEDICINE, December, 1902, gives in detail its method of preparation; but it may be stated that acetozone as it is marketed is composed of 50 per cent. of benzoyl-acetyl-peroxide, a soluble, crystalline substance which, when dissolved in water, is decomposed into several insoluble compounds and acetyl-hydrogen peroxide, which is the active germicidal agent. This remedy may be given in 5-grain (0.32 gm.) doses three times daily, or, what at present seems preferable, a solution containing from 12 to 15 grains (0.78 to 0.97 gm.) of the powder in a half-gallon of water may be employed. A solution of this strength is said to be equivalent in germicidal power to 1:1000 mercuric chloride solution, to be entirely innocuous, and, as a rule, to be easily administered to the patient. It is said to be rapidly absorbed, to augment the secretion of the kidneys, and to be eliminated in the urine as hippuric acid. In a series of forty cases of *enteric fever* treated by Abt¹ thirty-eight made good recoveries. The average age of these cases was 8.75 years. Hemorrhage occurred twice in the same patient, but other complications were infrequent, and the characteristic symptoms of the disease were less serious than usual. It is noteworthy, however, that this disease is not attended with a high mortality in children, and this fact should be remembered in examining statistics. On the other hand, a number of these cases were admitted from among the poorer classes, late in the disease in a serious condition, and their recovery warrants Abt in concluding that acetozone in conjunction with good nursing is of some value in the treatment of this disease. Harris² reports 128 cases treated with acetozone. In 64 of these cases the average age was eight years. Three of this number died. Of the other 64 cases the average age was 24.83 years, eight of which died. Harris is strongly in favor of the employment of this remedy, and states that

¹ Therapeutic Gazette, October, 1902.

² Ibid., March, 1903.

if it be given early in the disease and repeated at frequent intervals in favorable cases, the course of the fever may be reduced to the normal in from ten to twelve days. In his hands it has decreased the fetor of the stools, prevented tympanites, checked diarrhoea, and materially decreased the percentage of complications. Not including unfavorable cases, the mortality would be a little over 4 per cent.; the entire series of cases, however, show a mortality of 8.59 per cent. It will be noticed in reviewing these cases, that in all, when the temperature exceeded 102° F., hydrotherapeutic measures were instituted. It would seem improper to decry a remedy which apparently combats so many dangerous symptoms, but in order to determine accurately the actual value of acetozone, other measures intended to reduce the temperature or combat other symptoms should be withheld. M. C. Thrush¹ reports a series of 53 cases in which acetozone was apparently the only therapeutic measure employed, no reference being made to hydrotherapy. In this series of cases the ages ranged from eleven to thirty-eight years. No deaths occurred. All symptoms were ameliorated, hyperpyrexia was infrequent, and relapses and complications were rare. Burnet² has employed acetozone solution successfully in the treatment of soft chancre, abscess of the foot, and in laceration of the finger. He feels that it might also be given with advantage in the treatment of dysentery, tuberculous enteritis, and septicæmia. As yet we have no definite knowledge as to its use in these conditions.

The number of reports claiming a specific action for acetozone in the treatment of typhoid fever has been very large during the past year. This may be ascribed partly to the newness of the drug and partly to the desire of the profession to obtain an efficient intestinal antiseptic.

The teaching of H. A. Hare to his medical students in regard to intestinal antiseptics in typhoid fever is worth repeating. In the first place, the dose of any of these drugs is inadequate when we consider the length of the intestinal tract and the number of bacteria to be contended against, and besides by the time typhoid fever is recognized the typhoid bacilli have passed beneath the mucous membrane and are not reached by germicides. Another point emphasized by Hare is that the more highly organized a cell the more susceptible it is to injury; therefore an intestinal antiseptic given in doses sufficiently large to kill cell life as low in the scale as the typhoid bacillus would inevitably injure the cells of the human body. Dr. Hemmeter has called attention to this same point on page 67 of the present volume. On the other hand, experiments have shown in the rabbit that the use of aceto-

¹ Therapeutic Gazette, July 15, 1903.

² Medical Times and Hospital Gazette, October 18, 1902.

zone causes sterile stools, and it would seem probable that the use of drugs such as acetozone may inhibit the growth of intestinal organisms, even if they are not killed.

Adrenalin. The value of this substance is now thoroughly established, and the variety of conditions in which it may be applied with benefit is constantly increasing. The use of adrenalin in the treatment of *shock* has been ably demonstrated by Crile, who employs it intravenously in a solution of normal salt 1 : 25,000. This application of the drug has been treated in full by Dr. Bloodgood in the present volume. Mills and Muhlberg,¹ from animal experiments, conclude that adrenalin is a valuable stimulant, and is particularly adapted to those conditions associated with vasomotor collapse. Its efficiency as a hæmostatic is well illustrated by Otto Lange² in a report of six cases. In each instance it was tried as a last resort, and always successfully. Two cases were in individuals, probably hæmophilic, with open wounds; of the other four, one was a case of hæmoptysis, one of hæmatemesis, one of epistaxis, and one of persistent bleeding from a gastric carcinoma. The open wounds and epistaxis were treated by packing with strips of gauze soaked in a solution of adrenalin. In the other three instances the drug was administered internally. Lange also used the adrenalin as a prophylactic against bleeding in the case of gastric cancer after the first severe hemorrhage had been controlled. He intimates that it might be tried with benefit in cases of profuse uterine hemorrhage. Mills³ has also reported two cases of *hæmatemesis*, one due to malignant disease, the other to ulceration, in which the bleeding was readily controlled. In these cases Mills administered 25 minims of a 1 : 1000 adrenalin chloride solution in 90 minims of water. The preparation used by Mills was the 1 : 1000 solution made by Parke, Davis & Co. It may be stated here that the Parke, Davis & Co. solution is apparently the most desirable at the present time, and is the one recommended by most clinicians and experimenters.

In diseases of the *upper respiratory tract*, Douglas⁴ states that suprarenal extract, or adrenalin, which is practically identical in its action, is of the greatest value. This is particularly the case in acute inflammatory conditions of the nose, larynx, or pharynx, where the local application of adrenalin diminishes the secretion, reduces the congestion, and restores the breathing space. He also states that it may be used freely without the danger of forming a habit, as its slightly nauseating effects prevent too frequent use.

¹ Cleveland Medical Journal, December, 1902.

² Münchener med. Wochenschrift, January 13, 1903.

³ British Medical Journal, March 28, 1903.

⁴ New York Medical Journal, May 2, 1903.

Theoretically, Douglas believes that there may be a danger of producing atrophy or atrophic conditions from the too prolonged use of adrenalin.

Bouchard¹ recommends the local use of adrenalin for the reduction of *hemorrhoids* threatened with strangulation. He cites one case in which excellent results were obtained by applying gauze saturated in a 1 : 2000 solution of adrenalin. Eight minutes after the application the turgescence of the hemorrhoids became markedly diminished, and there was some diminution of the pain. Several more applications of a 1:1000 solution to both the external and internal hemorrhoids resulted in an apparent cure.

Duncanson,² who has used adrenalin in a variety of conditions, cites three cases illustrating the diversity of its application. In one case persistent bleeding from a lacerated wound of the tonsil was readily controlled by packing with gauze saturated in a 1:1000 solution. A severe epistaxis in the same case was later controlled in the same manner. The second case was one of *hæmaturia*, in which the bleeding was stopped in twenty-four hours by giving 5-minim doses of adrenalin every four and later every two or three hours.

Duncanson's third case was one of *chronic posterior urethritis*. Failing in achieving a cure with the usual local remedies, adrenalin was tried. He injected into the deep urethra 2 drachms of a 1:8000 solution, and allowed this to remain. In addition, the patient was given a 1:20,000 solution to be used daily as an injection. Later he was given several additional instillations of a half-drachm of a 1:1000 solution of adrenalin. The condition was apparently cured within a month.

Gans³ has also obtained good results in *posterior urethritis* with adrenalin, but cautions that care must be exercised when using it in the urethra because of untoward effects.

Bartrina⁴ believes that, because of the anæsthetic and hæmostatic properties of adrenalin, it might be of value in operations on the urinary organs, such as circumcision, meatotomy, and internal urethrotomy. He also suggests that it might be instilled into the bladder for the purpose of determining the source of blood in the urine. If after it has been thus applied there is no evidence of blood in the urine it would be evident that the bleeding was of vesical origin.

Bartrina has especially studied the effect of adrenalin chlorotone on *urethral strictures*, and has found that strictures which are so small as to prevent the passage of even a filiform will easily allow a small

¹ Abstract, *Lancet*, April 11, 1903.

² *British Medical Journal*, February 21, 1903.

³ *New York Medical Journal*, December 13, 1902.

⁴ *Annales des Maladies des Organes Génito-urinaires*, 1903, No. 11.

instrument to be passed five or ten minutes after the instillation of the solution. He recommends the following formula :

Adrenalin chloride		1 part.
Normal salt solution		1000 parts.
Chloretone		5 parts.

The chloretone is added to increase the anæsthetic effect. If protected from the light the solution can be kept indefinitely and can be sterilized by boiling without any alteration of its physiological properties.

De Bourmann¹ adds still another use to which adrenalin may be applied. He has found that the local application of a 1:1000 solution of adrenalin is valuable in *phototherapy*, obviating compression for the expulsion of blood from the part.

Antistreptococcus Serum. Cyril Ogle² has collected the cases in the literature in which antistreptococcus serum has been used in streptococcus infections. He states that it has been shown by laboratory experiments that the serum is applicable only for the particular germ or germs from which it has been prepared, and, furthermore, that the serum is either directly or indirectly germicidal in its action. Antistreptococcus serum does not act like diphtheria antitoxin, by neutralizing the toxins, but causes actual destruction of the bacteria.

He presents two tables, one of fifteen cases of general *streptococcic infection*, and the other consisting of nineteen cases of *malignant endocarditis*. In many of the cases the streptococci were shown to be present in the blood. From a study of these cases Ogle concludes that even the gravest infections are not hopeless if treated with the antistreptococcus serum. This is particularly true of malignant endocarditis where the germs in the vegetations on the valves are in constant contact with the blood stream. Owing to the fact that the staphylococcus is so often associated with the streptococcus, Ogle recommends that the antistaphylococcus serum also be given. He also advises a combination of the two sera in those cases where the blood cultures are negative. Sir Dyce Duckworth³ has reported a case of malignant endocarditis successfully treated by rectal injections of antistreptococcus serum prepared from mixed cultures. The serum was first administered subcutaneously without obtaining any amelioration of the symptoms. It was then determined to give 10 c.c. of the serum daily by the rectum. After the second day improvement became marked, and the boy made an excellent recovery.

ANTISTREPTOCOCCIC SERUM IN SCARLET FEVER. Mention was made in *PROGRESSIVE MEDICINE* for December, 1902, of the results

¹ *Annales de dermatologie*, July, 1902.

² *Lancet*, March 14, 1903.

³ *British Medical Journal*, May 23, 1903.

obtained by Moser with his serum in scarlet fever. During the past year several additional papers have appeared on the subject, and apparently excellent results have been attained. As has been stated before, however, there still remain many details to be settled before the serum is generally accepted. Moser¹ has made another report, giving the results in one hundred cases of a severe type in which his serum was used. His mortality rate was 6.25 per cent. Pospischell,² in an experience with twenty-six cases of a severe type, confirms the statements of Moser as to the value of his serum. In his cases he noted a marked fall in the temperature, reduction in the frequency of the pulse and respirations, and disappearance of nervous symptoms and cyanosis. The patients slept quietly and had a greatly improved appetite.

Baginsky,³ who used the Aronson serum, also attained favorable results. His cases were likewise restricted to those of a severe type. At the present time there is considerable difference in the preparation of the two serums. Both are prepared by injecting horses with streptococci taken from the heart blood of individuals dead of scarlet fever; but Aronson first passes the organisms through smaller animals in order to increase their virulence. In this way smaller amounts of serum can be used and the potentiality more accurately determined. The principal objection to Moser's serum is the large amount required, nearly 200 c.c.

Piorkowski,⁴ in a review of the various streptococcic sera, believes that those now in use are objectionable for two reasons: first, because of the high dosage required, and, second, because the various streptococci differ from each other, so that a serum may be effective for one form of infection and not for the others. He himself, with the veterinarian Jess, has for some time prepared an antistreptococcic serum which has been used successfully in *glanders*. The dosage is small—5 to 10 c.c.—and the exact strength can be accurately ascertained before using by injecting a mouse with a lethal dose of the bacillus mallei and then testing a given amount of the serum.

Meyer⁵ has tested the various antistreptococcus sera and found that Aronson's is the only one which absolutely protects animals against several times the lethal dose, and cures after infection. Aronson's serum does not kill the germs *in vitro* nor attenuate their virulence, but it does cause them to become less virulent when given in the peritoneum of a protected rabbit. Meyer believes that the serum causes an attenuation of the streptococci, and in this way they become an easy prey to the cells.

¹ Berliner klin. Wochenschrift, January 5, 1903.

² Ibid., December 1, 1903.

³ Zeitschrift f. klinische Medizin, 1903, Nos. 1 and 2.

⁴ Ibid.

⁵ Ibid., 1902.

Antithyroidin. Möbius¹ states that in 1901 he proposed to Merck, of Darmstadt, the preparation of a serum from the blood of herbivorous animals from which the thyroid glands had been removed. This serum he used in the treatment of *Basedow's disease*; it was obtained by removing the thyroid gland from a sheep, and after an interval of several weeks killing the animal. The serum was placed in sealed flasks containing each 5 grammes (75 μ). He first injected 1 gramme (15 μ) of the serum subcutaneously, but owing to the intense local inflammation and the fact that no improvement occurred in the symptoms, this method was abandoned. He afterward administered the serum internally, using sweet wine as a vehicle, in order to cover the taste of the added carbolic acid, which was used as a preservative. He reported his results at the Neurological Meeting in Jena. All of the patients treated had suffered for years with a well-developed type of the disease, and had been ineffectually treated with various other remedies. In no instance were any untoward disturbances noted, and it unquestionably did good.

While the number of pulse-beats was not materially lessened, the circumference of the neck was diminished, the goitre became smaller, and the patients stated that they felt quieter and slept better. Interruption of the treatment, as a rule, resulted in a return of the symptoms and an increase in the size of the neck. Owing to the expense of the serum, Möbius tried tablets prepared from powdered meat obtained from the sheep, and also serum tablets. In one instance in which the latter were used the patient rapidly became unconscious and died. Möbius states that as yet it is impossible to tell how much can be accomplished with the serum, nor is the dosage fully settled. He believes that if 5 grammes (75 μ) are given every other day, and produce good results, that more good may be accomplished by gradually ascending doses. That an absolute cure can be accomplished he considers as very doubtful, but he does believe it possible to maintain with small doses the good influence achieved by the larger ones. It would seem that by the continual use of small doses a perversion in metabolism is corrected as it is by the use of thyroid extract in myxœdema. While some unfavorable comments have arisen, the results at a number of clinics have been "encouraging throughout."

Otto Lanz² states that he performed thyroidectomy on a goat in 1894, with the idea of using the milk in the treatment of Basedow's disease. He now reports six cases of well-marked instances of the disease subjected to this form of serumtherapy. All of them were

¹ Münchener med. Wochenschrift, January 27, 1903, vol. 1., No. 4.

² Ibid., p. 140.

typical cases of the disease, and one of them (Case 3) was in the last stages of the affection. Lanz states that he has never seen recovery take place in a case so far advanced. Each one of the cases was supplied with a thyroidectomized goat, and consumed the entire milk supply of the animal. Rapid improvement followed in each case; the pulse-rate fell; the circumference of the neck diminished; the tremor disappeared, and the eyes became less prominent. In two cases there was no return of the symptoms when the treatment was stopped.

Goebel¹ has also had a favorable result with one case treated by the milk of a thyroidectomized goat. In this case, however, arsenic was used in conjunction with the milk.

Schultes² reports favorably on the method advocated by Möbius,⁴ and thinks greater significance should be attached to his results, as the question of suggestion was completely excluded.

Antitoxin (Diphtheria). That diphtheria antitoxin is sometimes of benefit in conditions other than the specific cause for which it was introduced has already been shown. In *PROGRESSIVE MEDICINE*, December, 1902, p. 349, its use in the various forms of *streptococcus* and *staphylococcus* infections was recorded. In the March issue of *PROGRESSIVE MEDICINE*, p. 207, mention is made of its use in typhoid fever. It has also been used with apparent benefit in pertussis.

Husch⁴ reports another instance. His case was that of a child suffering from a hollow cough and intense dyspnoea. The child was anæmic and poorly nourished, with a profuse eczematous eruption covering the skin of the trunk. In addition there was an eruption of prurigo on the extremities and marked glandular involvement. Careful examination of the throat, including a laryngeal examination, revealed nothing but reddening of the mucous membrane. Owing to the fact that diphtheria was present in the neighborhood, antitoxin was administered as a precautionary measure, and was followed by slight improvement. The cough and dyspnoea returning, however, a second injection was given, and in a few days was followed by a remarkable improvement of the entire condition. The eczema entirely disappeared within a week; the glandular enlargements disappeared; and the prurigo, with the associated itching, also vanished. There were no untoward effects.

The value of the antitoxin in diphtheria may now be considered as established beyond doubt. Most convincing reports as to its efficiency were recorded in last year's *PROGRESSIVE MEDICINE*.⁵

¹ Münchener med. Wochenschrift, 1902, No. 20.

² Ibid.

³ Loc. cit.

⁴ Klinische therap. Wochenschrift, December, 1902, vol. ix., No. 49.

⁵ *PROGRESSIVE MEDICINE*, December, 1902, p. 346, and March, 1903, p. 131.

Cairns¹ believes that in cases of malignant diphtheria the best method of administering the antitoxin is intravenously. He advocates the use of large doses (20,000 to 35,000 units) intravenously, and states that in an experience with twenty cases treated in this way he had no untoward results from the serum.

The class of cases which Cairns thinks are particularly adapted to this method of giving the serum are: (1) The malignant forms of the disease—i. e., those characterized by hemorrhage from the nose or into the skin, by great glandular involvement with marked cellular infiltration, and by extreme blanching of the skin; (2) when there is marked involvement of the lung, either when first seen or subsequently; (3) when the patient is in a moribund condition; (4) when profound toxæmic symptoms are present. Cairns states that the initial dose in such cases should be not less than 20,000 to 25,000 units. This method of administering the antitoxin seems worthy of a trial, especially in those cases in which the ordinary antitoxin treatment has been delayed, for it is in this class of cases that our present methods are often unavailing.

As an illustration of the importance of giving antitoxin at the earliest possible moment, the following figures may be quoted from an editorial in the *British Medical Journal* for March 14, 1903: "The mortality percentage of the first day cases (38) was 0.0; of the second day (170 cases) 4.1; of the third day (192 cases) 11.9; of the fourth day (137 cases) 12.4; and of the fifth and subsequent days (186 cases) 16.6. For five consecutive years there has not been a death at this hospital (Brook Hospital) among the cases that came under treatment on the first day of the disease, and of those coming under treatment on the second day of the disease the mortality has not exceeded 5.4 per cent. The figures afford striking evidence of the value of antitoxin, and particularly of its early administration."

Antitoxin Treatment of Tetanus. Von Schuckman² has made an exhaustive study of the literature on this subject during the years 1899, 1900, and 1901. He emphasizes the fact, long known, that the prognosis is more favorable in the cases with a long incubation period.

As to the most suitable method of administering the antitoxin, von Schuckman believes the subdural method, following a previous lumbar puncture, deserves the most confidence. He condemns the intracerebral injections as useless. Von Schuckman has also disproved the view expressed by Behring that the introduction of the serumtherapy not later than thirty hours after the beginning of the disease would be followed by a reduction of the mortality to 15 per cent. Of sixteen cases in which the treatment was instituted almost immediately after

¹ Lancet, December 20, 1902.

² Deutsche med. Wochenschrift, March 5, 1903.

the onset of the symptoms, not one recovered. Von Schuckman concludes that the tetanus antitoxin in its present form, even when given early, is not suited to achieve any noteworthy therapeutic result in the cure of tetanus.

In another study of the literature the late Frederick A. Packard and Willson¹ arrived at far different conclusions.

In an analysis of 1216 cases of tetanus treated with antitoxin administered in various methods, Packard and Willson² found that 702 recovered and 514 died, giving a mortality of 42.2 per cent. Various observers have placed the mortality of tetanus not treated by antitoxin at from 80 to 90 per cent.; Packard and Willson believe that about 80 per cent. is a fair estimate. During the Civil War in America the mortality from tetanus was 89.3 per cent. From these observations Packard and Willson conclude that tetanus antitoxin has reduced the mortality of tetanus from 80 to 40 or 50 per cent., and in the case of chronic tetanus from 40 to 20 per cent.

Argyrol (Silver Vitelline) is marketed as a brownish-black powder, soluble in about one-fourth its weight of water. It is said to contain 30 per cent. of metallic silver and to possess the property of penetrating deeply into the submucosa. It acts as a powerful germicide, allays inflammatory conditions, and is absolutely free from irritating properties. This remedy has been extensively employed during the past year in the treatment of both acute and chronic inflammations of the urinary, ocular, and nasal mucous membranes. Its success is apparently due to the fact that it contains a large proportion of silver, is non-irritating, and possesses the property of deep penetration into the tissues. Argyrol is employed both by injection and irrigation in solutions varying in strength from 1 per cent. to 25 per cent. Christian³ reports a series of 48 cases of gonorrhœa in which this remedy was employed to the exclusion of all others, and his statistics show a prompt cessation of the discharge in 31 cases, a gradual reduction of the discharge in 14 cases, and little if any effect in only 3 cases. In 4 cases there was a complete disappearance of the infective micro-organism in two days; in 5 cases the gonococci persisted in the urethra for over three weeks; in the remaining cases the average duration was slightly over eight days. He employed argyrol by injection in strengths varying from 2 per cent. to 5 per cent., except in those cases in which posterior involvement occurred, when a 1:2000 solution gradually increased to 1:500 was employed by irrigation. Swinburn⁴ speaks in the highest terms of this remedy, and usually employs it in the form of a 1:1000 or

¹ American Journal of the Medical Sciences, December, 1902.

² Ibid.

³ Medical Record, 1902, vol. lxii.

⁴ Ibid., October 11, 1902.

1:2000 hot irrigation. He recommends that irrigation should be made daily, and that the patient be advised to employ an injection containing from 2 per cent. to 5 per cent. as an adjunct to the treatment. In his experience, strong injections and deep irrigations are practically painless. In chronic cases needing a sound he employs a 5 per cent. ointment made with a base of anhydrous wool-fat to the exclusion of all other remedies. In his opinion it is more germicidal, more sedative, less painful, and productive of fewer complications than any other remedy. Bransford Lewis¹ reports that in a small series of cases he is satisfied with the efficiency of the remedy, but states that in a few cases its employment in his hands has proven a signal failure, as have all other remedies heretofore used. Pederson² thinks that argyrol bids fair to supplant all other organic salts heretofore marketed, and states that in his experience it is best employed by hand injection, beginning with a 2 per cent. solution. He believes that hot irrigations should be employed temporarily when the meatus is red and cedematous and a copious greenish discharge is present. A number of cases of gonorrhœa in both males and females have been treated in Horwitz's clinic in the Jefferson Medical College Hospital with the most gratifying results. Failures necessarily occur, but in the majority of instances the cause depends upon the negligence of the patient and not upon the inadequacy of the remedy prescribed. Adolf Alt³ states that a 10 per cent. solution of argyrol affords him excellent results in the treatment of catarrhal conditions of the conjunctiva; that a 25 per cent. solution may be employed with advantage in purulent conjunctivitis, and that a 50 per cent. solution has been eminently successful in gonorrhœal ophthalmia. Darier⁴ claims that it is without doubt the most efficient silver salt in the preventive treatment of ophthalmia neonatorum, and that its employment is unattended with discomfort. This remedy has also been employed in the treatment of acute and chronic inflammations of the nose, pharynx, and larynx, and is thought by Lederman⁵ to be of special advantage when chronic catarrhal changes of the larynx are manifest. In his experience he has also found it useful in cases of chronic nasopharyngitis in which postnasal accumulation of mucus was a prominent symptom, and in chronic suppurative otitis media.

Aristochine (Aristoquinine). This new compound, which is a neutral carbonic ether of quinine, is a white powder without taste or odor, freely soluble in alcohol and chloroform, but insoluble in water.⁶

¹ Medical Review of Reviews, December 25, 1902.

² Post-Graduate, March, 1903.

³ American Journal of Ophthalmology.

⁴ La Clinique Ophthalmologique, May, 1903.

⁵ Medical Record, November 22, 1902.

⁶ Nouveaux Remèdes, 1903, vol. ix., No. 7.

Aristochine forms soluble salts with the acids. These are stronger in quinine than many of the older salts commonly employed. The substance itself contains 91.6 per cent. of quinine, and may be used with advantage in many cases because of its insolubility in water. Its principal advantages over quinine are that it rarely produces the untoward effects which are frequently seen after the administration of the latter remedy, and that as it is not precipitated by alkalies it may be readily absorbed from the intestinal tract. According to Stursberg,¹ the experiments, while thus far insufficient to form any conclusions, are at least sufficiently conclusive to incite a further study of this new product. It is said to have a particularly efficacious action upon the infusoria, and because of this fact it has been advantageously employed in the treatment of *intermittent and remittent malarial fevers*. It has also been used in the treatment of *malarial headaches*, typhus fever, *epidemic influenza*, and *whooping-cough*. In doses of 1 grain (0.65 gramme) frequently repeated it is thought to be of value in *acute coryza*. The action of the remedy is said to be twice as intense as that of quinine. The ordinary dose as an antiperiodic is from 15 to 45 grains (1 to 3 grammes) during the twenty-four hours.

Arsenic. Jesionek² reports most favorable results from subcutaneous injections of a solution of *sodium arsenate*. It was employed in various skin affections, namely, *sarcomatosis of the skin*, *psoriasis*, *lichen rubra*, *dermatitis herpetiformis*, and *eczema*. It is also warmly recommended in any affection indicating arsenic. Painful nodules sometimes result at the site of the injection, and may persist for some time. On two occasions, out of 220 injections, suppuration took place in the nodules. Jesionek emphasizes the importance of sterilizing the solution in the small 2 c.c. flasks, as sterilization of the entire amount is worthless and inefficient. If the fluid is not sterile disintegration of the arsenic solution takes place from the deposition of molds. The injections are given, as a rule, every other day, but the total amount required varies with the particular disease under treatment. In *lichen rubra* and *dermatitis herpetiformis*, and similar affections demanding active arsenical medication, Jesionek found that 25 to 30 c.c. generally proved sufficient. He states that in an extensive experience with this form of arsenical treatment he has never noticed any toxic effects from the drug. Tolerance to this form of treatment also seems marked, and idiosyncrasies were not observed.

Priority in this form of arsenical medication is claimed by both Köbner and Ziemssen. Köbner, it appears, used the drug in the form of Fowler's solution as early as 1882, in a case of *sarcomatosis of the skin*.

¹ Münchener med. Wochenschrift, 1902, No. 45.

² Ibid., July 29, 1902.

Aspirin¹ has been introduced as a substitute for the salicylates. Being practically insoluble in water, it has little taste; therefore, one of the disagreeable features of the salicylates is entirely absent. Because of its insolubility it has practically no irritant effects on the stomach, and, although often used in large doses, only in the rarest instances produces nausea. When used in very large doses it may occasionally produce symptoms of salicylism. The indications for the drug are the same as the salicylates, namely, *acute articular rheumatism*, *subacute rheumatism*, and the various forms of *muscular rheumatism*, as *lumbago*. The drug is best administered in gelatin capsules in doses of from 5 to 15 grains, three or four times daily.

It is to be remembered that aspirin occasionally produces symptoms of cardiac weakness and even collapse, especially in depressing conditions, as influenza and scarlatina. For this reason the condition of the heart should be noted before and during the administration of the drug.

Atoxyl. This new compound is an odorless white powder having a slightly saline taste, and soluble in five parts of hot water; it contains the equivalent of 37.69 per cent. of arsenous oxide. Schild² has employed it in the treatment of a number of cutaneous affections in which arsenic was indicated, with excellent results in the majority of cases. He employed, by hypodermic injection, from $\frac{1}{4}$ to $\frac{1}{2}$ of a grain (0.012 to 0.022 gramme) in a hot aqueous solution once daily in the treatment of *alopecia areata*, *chronic exfoliative dermatitis*, *lichen rubra*, *psoriasis*, and the *xanthoma of diabetes*. The result was without benefit in alopecia and exfoliative dermatitis, but in herpetiform dermatitis a cure followed rapidly. In xanthoma the effects were quite apparent after the fourth injection, and in psoriasis the effects were manifest after the fifth or sixth injection, although in the latter cases the cure was not complete. Out of fourteen cases of lichen rubra nine were completely cured and the remaining ones materially benefited. Only one irritation, of an insignificant character, and no abscess resulted from the 500 injections employed in this series.

Bromoform Poisoning. An interesting case of bromoform poisoning has been reported by H. K. Dillard, Jr.³ The toxic effects of the bromine followed the administration of two doses of 4 drops each of the drug at intervals of two hours. Within a few minutes after the second dose the child's head suddenly fell forward, the eyes became hazy, she gasped for breath, the skin became cold and clammy, the body limp, and complete unconsciousness followed. Upon admission to the hospital, half an hour later, the pupils were contracted to pin-points and did not

¹ Editorial, American Medicine, April 25, 1903.

² Dermatol. Zeitschrift, April, 1902.

³ Therapeutic Gazette, April 15, 1903.

react to light. No convulsions were noted. The treatment consisted in the hypodermic administration of strychnine and atropine; brandy and aromatic spirits of ammonia by the mouth; lavage of the stomach; and an enema of soap and water. In addition the child was placed in a cold bath, followed by massage and artificial respiration. Unconsciousness continued for two hours and a half, and the recovery was quite as sudden as the onset. There was slight elevation of the temperature, with declination of the pulse and respiration at the time consciousness returned. Fifteen hours after admission to the hospital the child apparently had completely recovered, and was discharged. The interesting points to be noted are the rapidity of the onset, the corresponding rapidity of the recovery, the pin-point pupils, which might have led to an incorrect diagnosis of opium poisoning, and the fact that the poisoning was not due to concentration from the bottom of the bottle.

Camphor. A case of unusual interest is one reported, by C. S. White,¹ of camphor poisoning. The patient had taken three doses of a drachm and a quarter of spirits of camphor (U. S. P.) in order to bring on her menstrual flow. The three doses were taken within an hour. Shortly after the third dose she had eructations, with a marked taste of camphor, some headache, and a sense of oppression. For the relief of the latter she hastened toward a door for air, but fell and remained unconscious for about an hour and a half. When found she was able to answer several questions, but again lapsed into unconsciousness. The eyes rolled from side to side, and shortly after this symptom was noted there developed a well-marked epileptiform convulsion. A small amount of sugar was noted in the urine the following day; this later disappeared. The treatment used in this case, which ended in recovery, was the administration of alcohol and one dose of hyoscine hydrobromate ($\frac{1}{200}$ grain), the latter being given to quiet the marked nervous symptoms.

White was able to collect seventy-five cases from the literature, and states that his case was typical in character, the prominent symptoms being an epileptiform convulsion and headache.

The treatment recommended in the text-books is the administration of water to precipitate the camphor, followed by emetics. In addition, alcoholic stimulants and nitroglycerin or amyl nitrite should be given.

Hoffman² has advocated the use of camphor during the period of *morphine withdrawal*.

Erlenmeyer³ believes that the value of camphor in this class of cases is due to its stimulating effect on the vasomotor centre in the medulla,

¹ Therapeutic Gazette, July 15, 1903.

² Therapeutische Monatshefte, July, 1902.

³ Ibid., February, 1903.

and that in this way the tonicity of the bloodvessels and rise in arterial pressure is restored. In explanation of this theory Erlenmeyer claims that to those who are accustomed to its use morphine acts as a vaso-motor and cardiac stimulant, with a resulting increase in the blood pressure. Following withdrawal of the morphine there is a consequent fall in blood pressure. This is restored by using camphor.

Bronson¹ states that camphor is a drug which may be used with benefit in *pruritus*. Its good effects are produced by substituting for the itching a disturbance in the temperature sense, and, in addition, a certain degree of sedation.

Probably one of the most troublesome affections to deal with is a chronic *leg ulcer*, and any remedy which will give even temporary relief should be tried. Shulze² has obtained good results with camphor. He used the following formulæ:

R.—Triturated camphor	.	.	.	.	.	.	½ drachm.
Zinc. oxid.	.	.	.	.	.	.	7½ drachms.
Lard	.	.	.	.	.	.	6 ounces.

Or

R.—Triturated camphor	.	.	.	.	.	.	½ ounce.
Zinc. oxid.	.	.	.	.	.	.	3 ounces.
Olive oil	.	.	.	.	.	.	3 ounces.

Carbolic Acid. Duhr³ was led to use pure carbolic acid in the treatment of *smallpox*, from the excellent results he had obtained in the past with this drug in pustular eruptions of the skin. In the four cases which he had an opportunity of using carbolic acid in its pure form he obtained excellent results. The method he adopted was to apply the acid with a camel's-hair brush over a certain portion of the body each day, the face and head being the areas first selected. From this limited experience he concludes that the carbolic acid used in this way will arrest the eruption either in the papular, vesicular, or pustular stage.

Attention has been called in previous numbers of PROGRESSIVE MEDICINE to the danger of gangrene from the local application of even dilute solutions of carbolic acid. It would also seem that the continued application of the acid in its pure form might lead to irritation of the kidneys—organs which are already severely taxed with the excretion of the toxins of the acute infection.

Cecropia. According to Gilbert and Carnot,⁴ this plant resembles digitalis in its action, but is much less poisonous than the latter. The alcoholic extract, which was used in their investigations, was found to be of comparatively low toxicity, and could be used in large doses without causing any untoward symptoms. Like digitalis, it is cumu-

¹ Medical News, April 18, 1903.

² Abstract, New York Medical Journal, July 19, 1902.

³ Lancet, February 21, 1903.

⁴ Ibid., May 23, 1903.

lative in action. It increases the power of the contractions of the cardiac muscle and sphygmomanometric tracings show that the amplitude of the pulsations are more than doubled, and that this effect persists for a long time. Poisonous doses produce a slow pulse, with lowered arterial tension. The drug also acts as a diuretic, and will increase the amount of urine three or four times the normal amount. The alcoholic extract, in doses of 30 drops, was administered to patients suffering from cardiac lesions or extreme weakness of the pulse, and continued for periods of four to five days. By the fourth day diuresis was marked, the urine increasing from sixteen ounces to one hundred ounces daily. The general condition of the patients also improved markedly; dyspnoea became less urgent and the pulse-rate slower and regular. They state that this result was almost invariably obtained, and that the effects were comparable to those of digitalis.

Cerebrin Therapy of Epilepsy. The treatment of this distressing affection is one that has engaged the attention of the profession for years, and any preparation which offers the least hope of abating or curing the malady should be thoroughly tried. Lion¹ makes a second report on the results he has obtained with cerebrin, these results apparently being most satisfactory. As a preliminary measure, before instituting the use of cerebrin, Lion withdraws bromine or any of its derivatives and makes no restriction as to diet. He remarks that by doing this the patients feel better and that the action of the cerebrin is more prompt. He administers the drug in the form of tablets (2 grains daily) or as subcutaneous injections. Two to seven injections are given weekly. Later he changed his method by rapidly advancing the dose for a period of two or three weeks until 1.8 grains were taken per dose. This dose is administered once daily, preferably in the morning, with the stomach empty, and is repeated every third day. If the attacks simply become weaker and less frequent he increases the frequency, after two or three weeks, to every other day, and finally every day. Subcutaneous injections are made every third day, or two injections are given every second day. His report is based on fifteen cases, which he divided into four groups. The first group, consisting of two cases, was relieved from the attack from the first day. In the second group, consisting of six cases, the attacks disappeared almost completely. Considerable decrease in the number as well as a lessening of the attacks occurred in the third group of seven cases. In the fourth class, while the attacks increased in number they changed in character, the severe convulsions being converted into petit mal or slight attacks of dizziness.

A. Eulenberg,² while not expressing the enthusiasm for cerebrin that

¹ Deutsche med Wochenschrift, December 9, 1902, p. 40.

² Ibid.

Lion does, nevertheless believes that it has a certain value. His experience with the drug is limited to six cases, treated sufficiently long to form an opinion. These cases were all of a severe and chronic type, and apparently showed some improvement. Eulenberg, in addition to the cerebrin, employed a diet poor in salts, hydrotherapy, gymnastics, etc.

Chloral. Binz¹ advises the use of chloral as a cure for seasickness. He believes that the vomiting in seasickness is central in origin as the result of cerebral anæmia, and that this anæmia is produced by a narrowing of the arteries of the head due to the motion of the ship. As a prophylactic Binz recommends the taking of a full meal about an hour before embarking and that a recumbent posture be maintained. If seasickness then develops some drug which will dilate the cerebral blood-vessels should be given. Binz thinks the most suitable drug for this purpose is chloral hydrate.

Chloretone has been used by Bickle² for the prevention of post-anæsthetic sickness, with most satisfactory results. He administers 15 grains of chloretone two hours before operation. In forty-two cases in which Bickle has used the drug post-anæsthetic vomiting occurred in but four instances.

The Coal-tar Products. In a symposium on the coal-tar products held by the Philadelphia County Medical Society on December 10, 1902, and later published in the *Therapeutic Gazette* for January, 1903, a most excellent summary of our knowledge of these drugs was given. Sinkler, whose paper dealt with the treatment of *neuralgia* and other *painful nerve affections*, states that the coal-tar products are our chief reliance in treating these affections. Of the innumerable anilin preparations which have been introduced during the past twenty years none are equal to those first used, namely, *antipyrin*, *acetanilid*, and *phenacetine*. Sinkler has also found the *salicylates* most trustworthy, but they possess the great disadvantage of disordering the stomach. In conditions like migraine, which is often associated with nausea, this is especially objectionable. He believes that *aspirin*, which is efficient in smaller doses than the salicylates and rarely nauseates the patient, is of great value in neuralgia and other nerve pains. In administering the coal-tar products it is customary to give a cardiac stimulant, such as caffeine, ammonium carbonate, or camphor monobromate. The marked idiosyncrasy which is sometimes manifested toward the coal-tar products, particularly acetanilid, is well illustrated by a case coming under Sinkler's observation. In this case an extreme degree of cyanosis followed the dusting of acetanilid powder over a blistered surface.

¹ Centralblatt f. innere Medizin, February 28, 1903.

² Therapeutic Gazette, October 15, 1902.

In this connection may be mentioned a remarkable case of chronic *acetanilid poisoning* reported by Stengel and White.¹ The patient, a woman, had taken large amounts of the drug for the relief of neuralgia. Later she acquired the "acetanilid habit," although strenuously denying the use of any such substance. Owing to the extreme degree of cyanosis, dilated heart, and loud murmur, several competent observers had pronounced her condition as due to a cardiac lesion. The diagnosis of drug intoxication, probably one of the coal-tar products, was made from the symptoms and the blood picture, which showed marked destruction of red corpuscles as well as deformed and nucleated cells. Careful watching, which resulted in the finding of a concealed box of acetanilid tablets, proved this diagnosis to be correct. Following the withdrawal of the acetanilid the entire condition cleared up in a short time.

In the treatment of *skin diseases* Hartzell states that the coal-tar products possess two properties which make them of special value. In the first place, they are to a greater or less extent inimical to the lower forms of life so often present in cutaneous affections; and, secondly, they are analgesic when applied locally or taken internally.

The following formulæ, containing *carbolic acid*, are of service in allaying those diseases associated with itching:

R.—Acid. carbolic.	.	.	.	.	.	.	.	.	3ss.
Glycerini	.	.	.	.	.	.	.	.	3j.
Aque camphoræ	.	.	.	.	.	.	.	q. s. ad.	3iv.
R.—Acid. carbolic.,									
Camphoræ	.	.	.	.	.	.	.	aa	gr. xv.
M. et adde									
Lanolin,									
Petrolati	.	.	.	.	.	.	.	aa	3ss.

Hartzell states that in *pruritus* there are few or no contraindications to the use of carbolic acid.

Creolin and *trikresol*, both closely allied to carbolic acid, are applicable in the same diseases for which the latter is indicated.

Resorcin, in the strength of 8 to 10 grains to the ounce, is often of value in *eczema*, particularly the seborrhœic form. According to Hartzell, the drug gives better results in *eczema* when used as a solution than as an ointment. He believes that in *acne* we have no drug superior to resorcin, used as an ointment in the strength of 40 to 60 grains to the ounce. Applied in the form of a 40 to 50 per cent. plaster, the drug often aids in promoting cicatrization in superficial *epitheliomata*, particularly those appearing on the face.

¹ University of Pennsylvania Medical Bulletin, 1903.

For the relief of chronic painful *leg ulcers* Hartzell says that he knows of no drug which so readily controls the pain.

Naphthol or *beta-naphthol* is of special value in the treatment of *parasitic affections*. In *ringworm of the scalp* Hartzell has obtained better results with this preparation than any of the substances more commonly used. It is almost odorless, does not stain, and, although sometimes causing a slight burning when first applied, does not often produce a dermatitis. Aside from its use in parasitic diseases of the skin, Hartzell does not believe naphthol is of much benefit.

Orthoform has little value in dermatology. Owing to the prolonged local anæsthesia which it produces it was, when first introduced, believed to be a valuable remedy for leg ulcers and other painful cutaneous affections. Because it frequently gives rise to a painful dermatitis it has been largely abandoned in these conditions.

Hartzell states that he has obtained excellent results in chronic *urticaria* with phenacetin and acetanilid; he administers 6 to 8 grains of the former or 4 to 6 grains of the latter four times daily. Acetanilid may also be used as a dusting-powder for *ulcers* or *burns*, but it should always be borne in mind that even when applied in this way cyanosis and symptoms of collapse may occur. Antipyrine is to be remembered as a drug that will sometimes relieve *pruritus*.

Pearce's paper in the symposium referred to above dealt with the use of the coal-tar products in general nervous affections. He believes that in functional nervous diseases, such as neurasthenia and hysteria, these products are of questionable value and often lead to the drug habit. In organic central nervous affections, such as *brain tumor*, they should be given, if used at all, in small doses. Pearce states that in organic spinal nervous affections, as *tabes dorsalis*, the coal-tar products have their field of greatest usefulness, since in these conditions there is not so much danger of depressing effects.

Pearce calls attention to the great increase in the sale of the coal-tar products, particularly acetanilid, and cautions against the abuse of these most valuable drugs.

Codeine. The effect of the phosphate of codeine in *melancholia* has been recorded by Jules Clausse¹ from observations on fifteen patients. He found that marked improvement followed this treatment in cases suffering from melancholia with anguish and great moral suffering, and corresponding disturbance of general sensibility. These patients were rendered bright, cheerful, and happy, and sleep was obtained. It was administered in doses of 4 to 6 cgm. ($\frac{3}{4}$ to 1 gr.) hypodermically, or 6 to 8 cgm. (1 to 1 $\frac{1}{2}$ gr.) by the mouth. Its constipating effect was

¹ Thèse de Paris, 1902.

not so great as opium or morphine, and the respirations were increased in depth. It is contraindicated in cases suffering from intense excitement or *mania*, as it aggravates these conditions.

Cotoin and Tortoin. Cotoin is obtained from the plant *cortex coto*, while tortoin is a formaldehyde combination of cotoin.

R. Kerb,¹ after repeated experiments on animals and clinically, believes cotoin is useful in some cases of diarrhœa by reason of its bactericidal action. It does not affect all organisms, but in *typhoid fever* and *acute enteritis* it gave quite favorable results. It is given in doses of 1 to 3 grs. daily, and no unfavorable results follow its prolonged use. Tortoin was found to have no effect whatever.

Colchicum. Recent medical literature would seem to show that *gout* is becoming a more prevalent disease in the United States in all walks of life. In view of this fact, a paper by Ransom² on the colchicum treatment of gout is of particular interest. Ransom advocates the use of the alkaloid colchicine in the dose of $\frac{1}{100}$ to $\frac{1}{50}$ gr. rather than the wine of colchicum, which is more generally used. He believes that he obtains better and more constant results with the alkaloid, with less danger of disagreeable effects, than with the other forms. He is opposed to the plan of administering the colchicine to the point of active purgation, believing that better effects are secured with smaller doses, and besides the patient is much better with as little disturbance as possible. After the acute attack has passed off Ransom gives small doses in order to prevent chronic involvement of the joints, and also for the purpose of preventing acute exacerbations. In continuing the colchicum for considerable lengths of time Ransom does not think there is the slightest danger of creating a tolerance to the drug, or that any evidence of cumulative action will occur. He is also opposed to the view that colchicum increases the liability to retrocedent gout, as in his experience it is much more likely to occur without the colchicum than with it. In chronic nephritis his observations have led him to believe that colchicum not only does no harm, but may be administered to gouty individuals suffering from nephritis, with great benefit to the kidney lesion. He admits that with our present knowledge both the true nature of gout and the action of the colchicum are not known.

Collargol. The intravenous use of various germicidal preparations in the treatment of septic conditions has received a great deal of attention within the past year. The two substances most prominently before the profession at the present time are formaldehyde and silver or one of its compounds. The results so far obtained have been considered

¹ Deutsche Arch. f. klin. Med., Band lxxvi. p. 30.

² Medical News, June 13, 1903.

in detail by Ewart in *PROGRESSIVE MEDICINE*, September, 1903, by Norris in the same issue, and by Bloodgood in the present volume. Those obtained by the use of some one of the silver compounds appear the most favorable. The intravenous injection of collargol was originally introduced by Credé.¹

Jaenicke adds another successful case to those already treated with intravenous injections of collargol. His patient was a woman suffering from severe *puerperal sepsis*. Three weeks after the patient's delivery her condition became so desperate that it was determined to use collargol intravenously as a last resort, and 8 c.c. of a 1 per cent. sterilized solution was given in a superficial vein at the bend of the elbow. Two hours later she had a chill and a slight rise of temperature. The following day the temperature dropped slightly, but the condition was not materially improved. At the end of thirty-six hours, however, improvement became marked, and in spite of severe pain at the point of injection and a venous thrombus in the left leg, she was apparently completely cured twelve days later. The pain in the arm at the point of injection Jaenicke is unable to account for. He thinks it may possibly have been due to the escape of some of the solution in the subcutaneous tissues at the time of the injection, as the patient was very restless.

Copper. Price,² after an experience of many years with sulphate of copper in the treatment of *syphilis*, concludes that the treatment of syphilis in all its stages, inclusive of the cachectic and parasymphilitic forms, is well founded on sulphate of copper in the average dose of $\frac{1}{30}$ grain, aided by such a quantity of blue mass as is readily borne by the patient. In old syphilis in any form the copper salt must be given in minute doses, and gradually increased as tolerance is established, until the usual dose of $\frac{1}{30}$ grain is given, when the mercurial should be added in a rather small dose. It is sometimes advisable to give the medicine only on alternate days. In acute syphilis the copper salt is to be given in the dose of $\frac{1}{30}$ grain, and the mercurial added at once and increased as much as the patient will tolerate, in order that the disease shall be neutralized and eliminated as completely as possible.

Epicarín is a reddish, amorphous powder possessing a slight acetous odor, freely soluble in ether, alcohol, and petrolatum. Being a derivative of beta-naphthol and creolin, it was introduced into medicine as a substitute for the latter remedies in the treatment of parasitic skin diseases. Van Harlingen and Dillard³ deem it a very unsatisfactory remedy in the treatment of scabies, but report a series of thirty-one

¹ Berliner klin. Wochenschrift, 1901, No. 37.

² Medical Record, October 10, 1903.

³ American Journal of the Medical Sciences, June, 1903.

cases of *tinea circinata* and *tinea tonsurans* in which its employment afforded excellent results. They also claim that in one case of favus treated with this remedy the result was such as to encourage further trial. In the treatment of *scabies* they employed a simple 10 per cent. ointment in petrolatum. This failed to relieve the pruritus, caused considerable irritation, and made little impression upon the disease. In the cases of tinea the duration of the disease before treatment was instituted ranged from two days to eleven months. The cases treated early in the disease made rapid recoveries, one being completely cured on the tenth day. Those of long standing responded more slowly, but all were eventually either cured or greatly improved. In employing epicarin a 20 per cent. alcoholic tincture was found most satisfactory, but in some cases the irritation produced was sufficient to require its abandonment, and a 10 to 20 per cent. ointment substituted. The results shown by this series of cases apparently indicate that this remedy is a very satisfactory one in the treatment of ringworm of the scalp, but when the disease occurs on the body it is slow in its action and frequently productive of great irritation.

Ergot. Fenn¹ has reviewed the various conditions in which ergot has been used as a styptic. As ergot stimulates the vasomotor centres and contracts involuntary muscle fibres throughout the body, it causes a contraction of the arterioles and capillaries, and as a result an increase in tension in both the general and pulmonary circulation. It is this peculiarity of acting on the involuntary muscle fibres that makes ergot so valuable a drug in uterine hemorrhage.

In profuse pulmonary bleeding the source of which is apparently a ruptured artery, Fenn believes that ergot is absolutely contraindicated. The treatment in these cases should be directed toward quieting the circulation and lowering the blood pressure. In cases in which there is a slow oozing, possibly from capillaries in a mucous membrane, ergot may do good. Fenn, however, believes that such hemorrhages are often due to congestion, and will stop of themselves when the congestion is relieved. In Fenn's opinion, the disagreeable taste of the ergot and the fact that it is not well borne by the stomach forms another contraindication to its use.

Perhaps some of the disagreeable features of ergot mentioned by Fenn may be obviated by the preparation of Houghton.² The latter has proposed for hypodermic use a non-alcoholic, permanent, sterile, active preparation of ergot, containing a minimum amount of the inert and objectionable constituents of the drug. This is put up in hermeti-

¹ American Medicine, December 27, 1902.

² Therapeutic Gazette, July 15, 1903.

cally sealed bulbs. A great objection to the hypodermic use of ergot is the inflammatory reaction which it sets up at the point of injection. From animal experiments Houghton believes this new preparation is entirely free from any such action, and, in addition, is much less toxic than the preparations of ergot ordinarily used.

Houghton demonstrated that this new preparation is therapeutically active by administering it to cocks and pregnant animals; the comb and wattles of the former turned black, and abortion frequently followed in the latter.

Euguform is a fine, gray, almost odorless powder; its components are guaiacol, which is a derivative of wood tar, and formalin. Wiel¹ states that it has been quite extensively used in the treatment of *eczema*, and has also been used with benefit in *lupus vulgaris*, *soft chancres*, and in the treatment of *aseptic wounds* which are continually infected by the natural discharges. He states that it has also pain-relieving properties. It seems to be particularly adapted to conditions with pain and annoying itching, and the best results are obtained in the weeping rather than the dry forms of *eczema*. The drug is applied to the diseased surface in the form of a dusting-powder.

Euquinin. The number of drugs now recommended in the treatment of whooping-cough is already large, and yet, owing to numerous failures, any additional remedy which promises relief in this condition is worthy of a trial. Steckel² asserts that he has obtained good results with euquinin in pertussis, and states that it always shortens the attack and frequently aborts it.

He administers the euquinin to infants in suppositories in doses of 0.20 gramme twice daily. He has also given it in this way to older children who refused to take the drug by the mouth, often increasing the dose to 1 gramme (15 grains). The maximum dose by the mouth should not be over 0.70 gramme. When the whooping-cough is well developed small doses of codeine are also given for a few days for the control of the cough.

Ferroleum³ is a combination of cod-liver oil, iron, and phosphorus. The iron is present in a suitable form and is readily absorbed without giving rise to any of the disagreeable effects of some of the iron salts. While tasting of cod-liver oil, ferroleum is less disagreeable than the raw oil. It is recommended as a food and tonic in *wasting diseases*.

Ferropyrine. This compound of antipyrine and iron perchloride is an orange-yellow powder, soluble in five parts of cold water. Toff⁴ has employed it as a styptic, with excellent results. He states that its

¹ Berliner med. Wochenschrift, No. 16, vol. iv. p. 176.

² Klinische Therapeutische Wochenschrift, June 7, 1903.

³ Lancet, September 6, 1902.

⁴ Deutsche Praxis, November 25, 1902.

application to mucous membranes causes rapid arrest of *hemorrhage* without the subsequent formation of an eschar; also that its employment has no influence upon the cause of hemorrhage, with the exception of hemorrhagic metritis, where repeated applications of ferropyrine occasionally end by materially modifying the local condition. The author treated sixty-five cases of gynecological affections complicated with hemorrhage, fifty-nine of which responded promptly to the styptic action of the drug. As a rule, 15 minims (1 c.c.) of a 15 or 20 per cent. aqueous solution was introduced into the uterine cavity with a Brann syringe. In certain cases, however, where uterine irritation was marked, this quantity provoked painful uterine contractions, and the quantity injected was reduced to a few minims. According to the author, ferropyrine is especially useful in the treatment of severe *metrorrhagia*, and its application should be followed by tamponing and the hypodermic injection of ergotine. In his experience this method has been eminently successful in that class of cases which have failed to respond to the older methods. This remedy has also been recommended internally in the treatment of *neuralgias* and *cephalgias* resulting from chloranæmia. It is best prescribed as follows:

R.—Ferropyrine	0.6 gramme (10 grains).
Acidi hydrochlorici dil.	0.3 c.c. (5 minims).
Pepsini	5.0 grammes (1½ drachms).
Aque distillatæ	q. s. ad. 200.0 grammes (8 ounces).

Finsen's Treatment of Smallpox. Finsen¹ states that he has for the past ten years held that diffuse daylight is bad for smallpox, as it aggravates the skin lesions. He contends that cutting off the irritating chemical rays by an exclusive red light is an excellent measure. That this form of treatment may be successful, Finsen states that patients must come under treatment early, before the fourth or fifth day. If this precaution is taken, "suppuration of the vesicles—even in unvaccinated persons and in cases of confluent smallpox—will be avoided, one exception out of about seventy." When cases are submitted to the red-light treatment later than the fourth or fifth day of the disease Finsen believes it doubtful whether suppuration can be avoided.

In the recent epidemic of smallpox in Philadelphia, Schamberg² used the red-light treatment in two cases of smallpox. From this limited experience he concluded that the treatment was inefficacious. It must be said, however, that he submitted it to a rather severe test, as both patients were unvaccinated, delirious, and in the seventh or eighth day of the disease.

¹ British Medical Journal, June 6, 1903.

² Journal of the American Medical Association, May 3, 1903.

In a recent communication Finsen¹ repeats his faith in the efficiency of the red light to prevent suppuration in smallpox. He also states that while complete darkness will achieve the same end in cutting off the irritating rays, red light is much more agreeable. Finsen believes that dark yellow or dark green curtains would be equally efficient, providing they were dark enough to exclude the irritating rays.

Fluoroform. Stepp² recommends the use of fluoroform in *whooping-cough*, especially in those cases in which bromoform has proved unsuccessful. He gives a 2 to 2½ per cent. solution in daily doses of from 3 to 5 ounces. Fluoroform is odorless and tasteless. Stepp reports fifteen cases of whooping-cough in which by the use of fluoroform he obtained a rapid termination of the disease.

Formaldehyde. Vaillard³ recommends formalin in the treatment of *hyperhidrosis* of the feet. He states that the application of formalin will deodorize the perspiration when it is fetid and harden the epidermis, thereby avoiding the consequences of maceration. It also diminishes or totally suppresses the glandular secretion, and heals the excoriations by its local antiseptic action.

The strength of the solution used varies from commercial formaldehyde (40 per cent. formalin) to 2.5 per cent. In cases with much maceration and excoriation the weaker solutions are used first and then rapidly increased in strength.

The formalin is applied in the form of wet compresses to the soles of the feet and held in place by bandages. The compresses are changed every three or four hours. The period during which the applications are made varies from one to eight days, according to the strength of the solution. Where the strongest solution is used at once the effect is almost immediate.

Vaillard states that the results are only temporary, lasting from two or three weeks to three months. A renewal of the applications, however, quickly produces good effects.

Gelatin. The use of gelatin as a hæmostatic is still on trial, and the early favorable reports have of late given way to doubts as to its value.

The danger of tetanus from injections of imperfectly sterilized gelatin has been emphasized in previous numbers of *PROGRESSIVE MEDICINE*. The gelatin solution should be boiled at least two hours to destroy all tetanus spores.

Weil, Lumière, and Pehu⁴ have used gelatin internally in the treatment of *infantile diarrhœa*. They recommend that as pure a gelatin as

¹ Journal of the American Medical Association, November 14, 1903.

² Prager med. Wochenschrift, 1903, Nos. 11-14.

³ Archiv. d. Méd. et d. Pharm. Militaires, January, 1903.

⁴ Lyon Médical, August 23, 1903.

possible be used, and that it be absolutely sterilized: 10 c.c. of a 10 per cent. solution is administered in each bottle of food, and from six to eight doses are given daily. Excellent results were obtained in simple gastroenteritis, while in the diarrhœas complicating bronchopneumonia, splenomegaly, etc., the intestinal lesion was relieved without any effect on the principal affection. The gelatin was found to be valueless in cholera infantum.

Glycocholate of Sodium is recommended by Keown¹ in those conditions which are associated with a *torpid liver*, such as alcoholism, morphinism, neurasthenia, and melancholia. He has also seen marked benefit from its use in tuberculosis, diabetes, and convalescence from typhoid fever. In the latter conditions it promotes a rapid absorption and emulsification of fats, which is most desirable. In individuals with a muddy skin as the result of a torpid liver the drug is of service in removing the discoloration. Sodium glycocholate is administered in doses of 5 grains three times daily, and in cases of obstinate constipation the dose may occasionally be increased to 15 grains.

Gomenol has been employed for the relief of pain occurring from many acute inflammatory conditions, and has apparently met with some success. Maigrot² favors a 50 per cent. oily solution of gomenol in the treatment of *acute orchitis*. The testicle should be completely enveloped with absorbent cotton which has previously been saturated with the above solution. A suspensory is then employed to hold the dressing in place. He claims that in one case the pain entirely disappeared in twelve hours. A 5 per cent. oily solution has been recommended by Poisson³ for the relief of painful *cystitis*. He also advocates the injection of from 10 to 20 c.c. ($2\frac{1}{2}$ to 5 fluidrachms) of the solution into the bladder in the local treatment of *tuberculous cystitis*. A 50 per cent. oily solution may be tried as a remedy for fissured nipples, the breast being thoroughly cleansed before and after nursing. An aqueous solution containing 2 drachms (7.4 c.c.) to one quart (946 c.c.) has also been highly recommended as an injection in the treatment of *puerperal fever*. This remedy has also been employed in the treatment of *eczema* and of wounds and abrasions of the skin. It has also been recommended as an injection in the treatment of *pleurisy* and *pulmonary tuberculosis*. For the latter condition 1 fluidrachm (4 c.c.) of a 50 per cent. solution should be injected. Leroux believes also that the injection of 5 c.c. ($1\frac{1}{2}$ fluidrachms) may be of benefit as a palliative remedy for *whooping-cough*.

¹ Journal of the American Medical Association, August 16, 1902.

² Journal des Praticiens, 1902, No. 39, p. 616.

³ Thèse, Paris, 1902.

Hetol, although a somewhat new remedy in diseases of the respiratory tract, has, nevertheless, been used quite largely during the past year. Thus Krone¹ has employed it in *croupous pneumonia*, having been led to do so by an article by Passler.² Passler laid special stress on the therapeutic measures which may exert an influence on the development and continuance of the pneumococcic intoxication, and as a consequence Krone concluded that it would be worth while to make therapeutic experiments with a remedy which, from its physiological action, offered the possibility of checking the development of this intoxication. If it were possible to check the inflammatory process in the beginning, then the manifestations of the disease, ascribed by Passler as death by suffocation in consequence of the extended pneumonic infiltration, etc., would be practically set aside. Overwork of the right heart, in consequence of the resistance in the lesser circulation, could not take place, and there was less opportunity of a general pneumonic intoxication.

The danger of complications would, of course, not be set aside by the employment of such a remedy, but they might be favorably influenced in that they would be less dangerous and more restricted. In cinnamic acid Krone believes we possess a remedy which favorably influences the inflammation, and from manifold experiments and observations he was sure that the intravenous injection of cinnamic acid in pulmonary tuberculosis soon called forth a curative inflammation in the diseased lung tissue. He therefore attempted to cure inflammation by inflammation, provided that the exact dose and degree of inflammation could be measured and eventually prove a healing agent. The favorable influence of balsam of Peru, of which cinnamic acid is the chief constituent, in acute inflammatory processes, led Krone to believe that in the cinnamic acid we had a preparation which would exert a favorable influence on inflammatory processes.

Cinnamic acid and its derivatives are in the highest degree chemotactic, and thereby possess the power of attracting leucocytes. That there is, in addition, some other factor involved has also been suggested, namely, that it incites an inflammation. Possibly it possesses the property of combining itself with the inflammatory exciter.

Krone claims that he has demonstrated the harmlessness of the hetol injections by experiments on his own person. He gives his results in seventeen cases of croupous pneumonia receiving hetol injections. The results were favorable in fourteen; in the remaining three, two were alcoholics, one of them dying; the other was apparently uninfluenced by the hetol, while a third failure occurred in a case probably not suffering with a pure pneumococcic infection. The drug was injected in

¹ Münchener med. Wochenschrift, March 3, 1903.

² Ibid., 1901, Nos. 8 and 9.

doses of from 0.004 to 0.002 gramme. In one case in which the leucocytes were counted before and after the hetol injection there was a rise coincident with the administration of the drug. He concludes from his observations that he can state with positiveness that in hetol or cinnamic acid we have a remedy which, when employed early and in properly regulated doses, exerts a favorable influence on the course of fibrinous pneumonia. He believes it acts by its own inflammatory excitation in opposition to the pneumonic inflammation in the first stage; that it reduces the fever, produces light resolution with easy breathing, and prevents the appearance of a destructive general infection.

The use of hetol in *pulmonary tuberculosis* was mentioned in PROGRESSIVE MEDICINE for December, 1902. Additional evidence as to its value is supplied by Landerer.¹ He bases his treatment on the fact that intravenous injections of hetol cause an increase in the number of leucocytes, and that these surround the tuberculous foci. As a result of this leucocytic infiltration a fibrous wall is formed about the tuberculous focus, with subsequent absorption of caseous material and entire disappearance of the bacilli. The intravenous injection of the drug is advocated by Landerer because subcutaneous injections are painful, intramuscular injections are uncertain, and administration by the mouth has practically no effect. Care must be taken that the drug is chemically pure and that proper antiseptic precautions are taken in making the injection. He begins the treatment with injections of $\frac{1}{120}$ to $\frac{1}{60}$ grain three times a week; this dose may be increased to $\frac{1}{6}$ or $\frac{1}{4}$ grain. The dose should be adapted to the condition of the patient; in nervous women the maximum dose is sometimes reached with $\frac{1}{12}$ grain. If the dose is too large a slight elevation of temperature occurs, the patient complains of pressure in the head, restlessness, and anorexia. These symptoms quickly disappear if a smaller dose is subsequently given. The treatment should be continued for three or four months. Landerer distinguishes two types of fever in tuberculosis—one with slight evening variations, which disappears in from one to four weeks from the hetol injections; and the second due to mixed infection. His best results were obtained in cases with slight pulmonary destruction and absence of fever. A solution of colloidal silver was injected into the cases with mixed infection in the hope of converting them into uncomplicated tuberculous infections. If this were successful hetol injections were given. Landerer claims 70 to 75 per cent. of cures or marked improvement from this form of treatment.

Drage² has also used sodium cinnamate in the treatment of pulmonary tuberculosis. He administers it subcutaneously in the form of a 10

¹ Journal of Tuberculosis, January, 1903.

² Lancet, May 23, 1903.

per cent. glycerin solution, and claims excellent results. Drage has also used the injections in one case of carcinoma of the tonsil, with marked inhibition of the growth.

Hydriodic Acid. In an editorial in the *Therapeutic Gazette* for September 15, 1903, Hare calls attention to the value of hydriodic acid in those cases in which the iodides are badly borne. Where it is deemed essential that an iodine influence be continued, hydriodic acid will often answer every purpose. It may be given in doses of from 20 to 40 minims or even 60 minims, well diluted in water, about an hour after meals. When there is a tendency to gastric disturbances they may sometimes be controlled by the use of Vichy water or ordinary water to which has been added a small quantity of sodium bicarbonate.

Ichthyol. Williams¹ has obtained excellent results with ichthyol in tuberculous cases of a hemorrhagic character, and has also found it of service in *tuberculous ulcers* of the tissue and caries of bone. In tuberculosis his method is first to curette the diseased area thoroughly and then pack with gauze saturated with the ichthyol. In laryngeal tuberculosis it is serviceable as a 10 per cent. spray because of its astringent properties. Williams' method of treating ulceration of the larynx is first to curette thoroughly and then make an application of ichthyol by means of a probe wrapped with cotton. To avoid the disagreeable taste of the drug when given internally Williams prefers administering it in capsules.

The initial dose is 10 minims three times a day; this may be gradually increased to 50 or 60 minims three times daily. It is best given thirty or forty minutes after meals. He has noticed that in about 10 per cent. of cases a faint bronzing of the skin occurs after its use, but that this soon entirely disappears. Williams does not claim a specific action for ichthyol in tuberculosis, but thinks that it does aid in absorbing the infiltrated areas.

Minor, of Asheville, states that a combination of ichthyol and iodoform (3 grains each), given internally, is of service in *tuberculous diarrhœa* or in the intestinal disturbances sometimes occurring in pulmonary tuberculosis.

Post² reports good results from the local use of ichthyol in rheumatism both in the acute and chronic varieties.

De Brun³ claims to have obtained excellent results with ichthyol in the treatment of *chronic bronchitis*. He found that there was marked diminution of the cough and expectoration, that the dyspnoea disappeared, and the patients slept well at night. The physical signs also

¹ Journal of Tuberculosis, October, 1902.

² Therapeutic Gazette, September 15, 1902.

³ Journal des Praticiens, November 29, 1902.

showed fewer râles and an improved vesicular murmur. De Brun found the following formula an excellent method of administering the ichthyol :

R.—Ichthyol	gr. xxx.
Glycerin,	
Syrup of orange	aa 3 ss.
Water	3 iii.

Sig.—One-half to one teaspoonful in water several times a day.

Iodothyryn. Roos¹ after an extended experience with iodothyryn in various affections has published his results. The dose ordinarily employed is 1 gramme (15 grains), the preparation being a trituration of milk-sugar with an effective organic iodine combination of the thyroid gland. It is so prepared that 1 gramme (15 grains) of the powder contains 0.3 mg. of iodine in the organic iodine combination. This is the average quantity of iodine contained in 15 grains of fresh thyroid gland of sheep, according to the investigations of Bauman. That the dosage according to the iodine quantity is authorized, was proved by Roos from the fact that the feeding of simple dried and powdered thyroid gland of varying strengths of iodine had a more pronounced influence on metabolism and struma in proportion to the amount of iodine contained, and that thyroid gland without iodine is really ineffective. The most extensive application of the drug has been in cases of *goitre* (endemic struma).

In cystic goitre it is useless ; in dense, fibrous goitres in conjunction with iodine inunctions good results are obtained ; while in the parenchymatous goitres complete reduction is possible. Many surgeons are opposed to its use, but Kocher in many cases directly recommends a preliminary thyroid gland therapy previous to the operation. Roos believes that all cases should first be submitted to this form of treatment before appealing to surgical aid. The quantity, 1 gramme (15 grains), is generally taken at one dose after breakfast in powder or tablet form. In many cases he gives 1 gramme (15 grains) twice daily. In administering 1 gramme daily there is an occasional interruption after six or eight doses, and with a daily dose of 2 grammes an interval of three to four days, and then begin afresh. When but 1 gramme is administered it is continued for longer periods without intermission. Children receive on an average 0.3 to 0.5 gramme daily, and very small children (one of nine months) receive 0.1 gramme two or three times per week.

Cretinism has been treated with iodothyryn, but in the adult form it was useless ; in two children, however, remarkable results were obtained, both the physical and mental development being rapid.

¹ Münchener med. Wochenschrift, September 30, 1902.

Roos states that inflammatory and malignant enlargements are not suitable for the iodothylin, although Reveirre, of Lyons, seems to have procured favorable results. As to the use of iodothylin for the purpose of influencing metabolism, especially the reduction of *obesity*, opinion seems to be divided. Roos, however, believes he is justified in using it for this purpose, and that he has done so with more or less good results. He gives in detail four cases in which the iodothylin was administered in obesity. The dose employed was from 1 to 2 grammes daily. In two of the cases there was reduction in the weight, with no untoward symptoms; in the other two, while the weight remained unchanged, they were relieved of their disagreeable symptoms. In addition, he had the results in a case of obesity communicated to him. In this case there was a reduction in the weight and relief from annoying cardiac symptoms. He also tried iodothylin in *arteriosclerosis*, another condition in which opinion differs as to its use. In two cases, of which he gives the details, a clear influence on the disease was not obtained.

Two cases of long-standing *psoriasis* showed marked improvement under iodothylin, making the subsequent external treatment much more effective.

Syrup of the Iodide of Iron. Hodge¹ calls attention to the variety of conditions in which this preparation is of service.

1. In the early stages of phthisis given in 1-drachm doses three times daily. It promotes secretion, acts as a diuretic, and the weight of the patient increases.

2. In the dry, rasping coughs of bronchitis it will soon relieve the congestion and increase the expectoration after the ordinary cough syrups have failed.

3. In amenorrhœa and dysmenorrhœa, in scrofulous women especially, it is of benefit, the menstrual flow often becoming properly regulated. The dose in such cases should range from 20 to 30 drops after each meal.

4. In anæmic individuals suffering from chronic rheumatic gout it is of service, given in doses of 1 drachm combined with cod-liver oil.

5. In constitutional syphilis it is a valuable remedy.

6. In children with a strumous diathesis, enlarged cervical glands associated with catarrhal conditions of the throat and enlarged tonsils it should be administered in 10-drop doses three times daily. It produces a marked alterative effect, hastening absorption and reducing the swollen gland, and at the same time increasing the hæmoglobin.

7. In cases of delayed resolution following croupous pneumonia it is a splendid reconstructive and tonic.

¹ Cincinnati Lancet-Clinic, 1903.

8. In the incontinence of urine in children it serves a good purpose given in 20 to 30-drop doses in water after meals.

Hodge recommends that the preparation, as a rule, be given alone and well diluted after meals.

H. A. Hare has found the syrup of the iodide of iron of benefit in gonorrhœal arthritis.

In chronic bronchitis and pleurisy Shoemaker¹ recommends the following formula :

R.—Potassi iodidi 3 iv.
 Syr. ferri iodidi,
 Glycerini aa 3 iss.
 Sig.—One teaspoonful in water or milk after each meal.

Isarol. This preparation has been introduced as a substitute for ichthyol, and is highly commended by Golinier.² The latter drug was introduced by Unna nearly two decades ago, and it was he who first pointed out its origin from bituminous stone and its treatment with concentrated sulphuric acid. Unna also pointed out its value in dermatology. From the raw ichthyol the Gesellschaft f. Chemische Industrie in Basel has produced a new product which they first named ichthyodin and later isarol. Isarol is a brownish-red, thick, liquid solution of peculiar smell, resembling ichthyol, and contains 8.5 to 9.5 per cent. of sulphur. It dissolves itself entirely clear in water; with ten parts of spirit of wine (95 per cent.) it gives an incomplete solution like ichthyol; it burns and leaves no ashes after combustion.

Various authors, especially Unna, are inclined to ascribe the good effects of ichthyol to its high sulphur contents; but practical experience has shown that the alkaline combinations of sulphur which are employed in chronic skin affections possess but small therapeutic value. Isarol is said to show a more constant composition and greater chemical purity than the Hamburg ichthyol. It contains in one hundred parts 51.9 per cent. of substance insoluble in benzine, 43.7 per cent. of substance soluble in benzine, and about 1 to 4 per cent. of volatile oils.

In 1900 Hössline, of Basel, from a series of observations with isarol, considered it equal in every respect to ichthyol. This led Golinier to give the drug an extensive trial in skin affections. In *eczema* of any type he found it most efficacious and fully up to his expectations. The drug was employed pure in the skin affections, partly as a poultice and partly with a bandage of cotton. In chronic joint affections, such as *chronic arthritis* and *chronic articular rheumatism*, the joints were painted with a 20 per cent. isarol collodion. In these cases the swell-

¹ Journal of the American Medical Association, October 24, 1903.

² Therapeutische Monatschrift, March, 1903.

ing of the joints was reduced, and the pain ceased. In the form of a 10 per cent. salve, with vaselin or lanolin, Golinier obtained favorable results in the treatment of chronic *leg ulcers*. The secretion of the ulcer diminished, the ulcerating surface became smaller, pain decreased, and the swelling and reddening of the adjacent skin showed marked improvement.

Another advantage in favor of isarol over ichthyol is the cheaper price of the former.

Lead. Biddle,¹ who has had a large experience in the treatment of *burns*, highly recommends a mixture composed of carbonate of lead, powdered acacia, bicarbonate of soda, and linseed oil. The mixture should be thin enough to spread easily on cotton flannel. As a preliminary step Biddle removes all the devitalized skin that can be cut away with the scissors, believing that a good dressing is a better protection than dead skin or necrotic tissue. The lead mixture should be spread on the flannel so as to make as impervious a dressing as possible. A roller bandage is used to hold the dressing in place. The dressing is changed as often as necessary, and is continued for ten days or two weeks, and sometimes longer, depending on the character of the burn. Biddle states that if this dressing is properly applied the patient will have few, if any, scars. When granulations get too high salicylic acid should be dusted over the surface. Biddle advises that skin grafting should be done early in all cases where there is much destruction of tissue, or in parts near the tendons, or where contraction would produce unsightly deformity. If any evidence of lead poisoning appears Biddle administers sulphate of magnesium, and in a short time the patient will be in his normal condition.

Lysoform is a formic aldehyde soap resembling glycerin and possessing marked antiseptic properties. It is miscible in water in all proportions, but becomes slightly turbid on standing. Diluted with an equal part of water, it is an excellent disinfectant for the hands, and in strengths of 1:100 or 1:200 is a powerful deodorizer. It should not be heated above 100° F., as the formic aldehyde may be volatilized. Tunncliffe and Hewlett² suggest that lysoform may be employed as an antiseptic *mouth-wash* in the strength of from 1 to 3 teaspoonfuls to the pint; as a *vaginal* or *uterine douche* in the strength of from 4 to 6 drachms to the pint, and for abscess cavities, etc., up to 6 drachms to the pint or stronger. For disinfecting the hands or instruments the strength should be from 6 to 12 drachms to the pint. It is a most efficient deodorant in the proportion of 1 fluidounce to the gallon. A

¹ Pennsylvania Medical Journal, August, 1902.

² Therapeutic Gazette, December 15, 1902.

solution of lysoform containing $\frac{1}{2}$ ounce to the pint is a reliable means of disinfecting urine or feces.

Lysol. Owing to the fact that cases are occasionally reported as having been poisoned by the use of lysol, Link¹ conducted some experiments to determine its exact toxicity. Details are given of a case which had accidentally received 50 c.c. of undiluted lysol in an enema. The injection was followed by unconsciousness, stertorous breathing, a feeble pulse, and rigidity of the extremities. Death occurred within a few hours.

Link found that the injection of lysol into the large intestine or stomach of rabbits produced erosions of the mucous membrane similar to the post-mortem findings in the case mentioned. He also found that the symptoms of poisoning depended on the total dose, and did not vary with the strength of the solution.

Mercury. The general impression among neurologists is that the administration of mercury is unavailing in parasymphilitic infections such as *tabes dorsalis* and *general paralysis of the insane*. Lemoine² has reported twelve cases, six of each disease, in which he obtained good results with mercury, particularly in the cases of paresis. He administered the benzoate of mercury hypodermically in daily doses of 0.03. The injections were given deeply into the subcutaneous tissues or intermuscular fascia, and continued for fifteen days, with an equal period of rest. The duration of the treatment varied from three or four months to one year. Improvement was marked in the cases of paresis, consisting of a restoration of speech nearly to the normal, recovery of the faculty of memory, and a regaining of co-ordination, with abolition of tremors. While some enfeeblement of memory persisted, the physical and mental improvement was striking in all six cases.

In the six cases of *tabes dorsalis* improvement was only slight. The knee-jerks were not restored, and the lightning pains continued. The ataxia, however, was diminished.

Whitefield³ reports an unusual skin eruption occurring from the local application of mercury. A woman suffering from varicose veins of the leg, with ulceration, was given a salve of dilute ammoniated mercury to relieve the irritation. A similar application was made to relieve irritation of the skin over the left elbow. The day following the application, when the dressings were removed, a number of vesicles were noted. Two days later there were a number of these vesicles, herpetiform in character, scattered over the body. Later the leg was washed in a weak solution of the biniodide of mercury prior to an operation, and a similar vesicular eruption appeared.

¹ British Medical Journal, June, 1902.

² Revue Neurologie, July 30, 1902.

³ Therapeutic Gazette, November 15, 1902.

Various mild mercurial preparations, including blue ointment, were applied, and always with the same effect.

QUICKSILVER. Two cases of acute intestinal obstruction, occurring in men aged, respectively, sixty and eighty years, are reported by Harrison¹ as having been successfully treated by means of quicksilver. One-half pound of the quicksilver was administered by the mouth in each instance. Pain was relieved by 1-grain doses of opium every four hours. Recovery took place in each case. Harrison states that in neither case was there the least evidence of mercurialism or of any increase in the abdominal pain.

CALOMEL. Hypodermic injections of calomel are recommended by Meshtcherski in the treatment of chronic *leg ulcers*. He reports a case in which the ulcer was of seven years' duration, and was furthermore complicated by elephantiasis. Meshtcherski, having in mind the beneficial effect of calomel in elephantiasis, used the drug for the relief of the ulcer. One grain of calomel was injected hypodermically near the ulcer, and in addition tight bandages and boric acid fomentations were used. The injections were given at intervals of one week. After the fourth injection the ulcer had healed completely and the cedematous and thickened condition of the leg had greatly diminished. It is quite possible that in this case the healing of the ulcer was dependent on the improved condition of the elephantiasis. However, in cases of obstinate leg ulcer which do not heal under the ordinary measures this method may be tried.

MERCUROL is one of the newer preparations of mercury, being a combination of the latter and nucleinic acid. Dressman² has made a report of the results obtained with this drug. He states that in chronic ulcerations, such as *leg ulcers*, it is most efficient as a 2 to 5 per cent. salve. Good results were also obtained in exuberant granulations and benign ulcers, when a caustic effect is desired, by using mercurol as a dusting-powder. Dressman used it most extensively in venereal diseases: (1) in *gonorrhœa*, as an injection, in a $\frac{1}{2}$ to 2 per cent. solution; (2) internally in *syphilis*, in the dose of from 0.05 to 0.1 grain, and (3) in *suppurating buboes*. The buboes were punctured and injected with from 15 to 75 minims of a 2 per cent. mercurial solution after the pus had been evacuated.

Methyl Atropine Bromide. This substance, which has been employed to only a limited extent, may be described as a white, crystalline powder, freely soluble in water and dilute alcohol, but only slightly so in pure alcohol, ether, and chloroform. Experiments on cats indicate

¹ British Medical Journal, April 26, 1902.

² Münchener med. Wochenschrift, 1903.

that this derivative of atropine increases the rapidity of the heart's action, raises blood pressure, and acts as a respiratory stimulant. Its action, however, is said to be much slower than that of the latter remedy. The special advantages claimed for this substance are that it does not cause the intoxication frequently seen after the administration of atropine unless given in excessive quantities. It is also stated that methyl-atropine-bromide has little or no effect upon glandular secretions, and because of this fact it may be advantageously employed in combating the *night-sweats of phthisis* and those resulting from nervous depression. It has also been recommended as a remedy for excessive salivation. For the latter condition it may be employed in doses of $\frac{1}{10}$ grain (0.006 gramme). In the treatment of night-sweats it has been employed in the dose of $\frac{1}{2}$ grain (0.012 gramme).¹

Methylene Blue. As has been pointed out before, it is important to bear in mind the distinction between methylene blue and methyl blue, as toxic effects have been reported from the use of methyl blue.

Moore and Allison² recommend as a simple test the one given in Foster's *Practical Therapeutics*. A solution is made which is of a greenish color if methylene blue is used, while with methyl blue there is a blue color. By adding a small quantity of sodium hydroxide the methyl blue solution turns to a purplish-red, while the methylene blue solution becomes a deep violet color.

Moore and Allison have studied the effects of methylene blue in *malarial fever*. They state that while it will kill the malaria parasites, it is less certain than quinine. Although its effects are more unpleasant than quinine, it is a drug to be remembered in cases with an idiosyncrasy to quinine and in chronic cases of malaria. Moore and Allison believe that methylene blue would probably be of use in malarial hæmoglobinuria, although this has not as yet been determined. Its effect on pregnancy complicated by malaria is also undetermined. The dose recommended is 20 grains daily, administered in capsules of 5 grains each. To each dose 2 grains of powdered nutmeg should be added in order to prevent the tendency to strangury.

Herbert³ has tried methylene blue in pulmonary tuberculosis. His results have led him to the belief that it is of little value in this affection. As it checks the expectoration, the bronchial tubes become impeded, giving rise to a sensation of choking, and even dyspnoea.

Naphtalan. This substance was originally introduced by Rosenbaum. It is a semifluid of dark green color, and has an almost imperceptible odor. It is analogous to ichthyol, but is to be distinguished

¹ Nouveaux Remèdes, 1903, vol. xix., No. 6.

² Medical News, December 6, 1902.

³ Journal of Tuberculosis, 1903.

from it by its more feeble odor. Chemically it appears as a composition of naphtha and $2\frac{1}{2}$ to 4 per cent. of water-free soap. It is neutral in reaction, does not mix with water or glycerin, but does mix very readily with fats. It is soluble in ether, chloroform, and benzine, but insoluble in alcohol. The value of naphtalan is its power to withdraw moisture from the tissues. Necrotic as well as damaged cells of an inflamed area are dissolved, and the less damaged cells are regenerated and stimulated into activity.

Awerbach,¹ of Charkow, believes it is particularly adapted to all forms of *eczema* and inflammatory conditions of the epidermis, as it does not produce irritation and is well borne by nearly every skin. In addition it dries up the lesions, relieves the pain and itching, and aids in the regeneration of the epidermis and absorption of the infiltrate. His report is based on 180 cases in which excellent results were obtained.

The drug was prescribed in the form of a paste, which was applied two or three times daily, generally without any dressing. The following is the formula used :

R.—Naphtalan	20 parts.
Zinc. oxid.,	
Aml. trit. puri.	aa 10 parts.
Menthol	0.5 to 1 part.—M.

The menthol was added in order to increase the property of the naphtalan to allay itching. Awerbach calls attention to the fact that the drug does not possess an objectionable odor and is easily and cleanly applied. The principal bar to its use at present is its high price.

Paraldehyde. Brunke² believes that paraldehyde is superior to the newer hypnotics and morphine in the treatment of insomnia. He states that it is of value in all forms of *insomnia* except those due to acute pain, and in certain forms of violent psychoses. In those states of excitement in the insane characterized by great motor restlessness, volubility, and violent and destructive tendencies, Brunke states that it is not suitable, and besides it is frequently impossible to give it in these conditions.

The advantages claimed by Brunke for paraldehyde are that it is safe, certain in its action, free from unpleasant effects, and the sleep it produces is perfectly natural, the patient awakening feeling refreshed and strengthened. The usual dose required to produce sleep is 45 grains, and this dose may be doubled if necessary. Brunke has not observed an instance of addiction to the drug.

Acute poisoning from the therapeutic use of paraldehyde does not occur. In a few instances where the drug had been taken in large

¹ Monatshefte f. prakt. Dermatologie, October 15, 1902.

² Münchener med. Wochenschrift, November, 1902.

daily doses for months symptoms resembling alcoholic delirium developed, but quickly disappeared on the withdrawal of the drug.

Pertussin (extractum thyrin saccharatum) has been prepared from the thymus gland with the idea that it would be of value in *whooping-cough*. Bausch,¹ in an experience with thirty-eight patients suffering from pertussis, found it of very doubtful value, and states that it is to be thought of only when other measures fail. It is given in doses of one teaspoonful every three hours to children six months old, up to three years a dessertspoonful, and up to six years and over three-quarters of a tablespoonful. Model² reports that he obtained excellent results with pertussin in *acute laryngitis*.

Potassium Chlorate. Remy³ recommends potassium chlorate in cases of *habitual abortion* not due to epidemic disease, syphilis, or local lesions of the uterus. As soon as the patient becomes pregnant Remy advises that she be given 3 grains of potassium chlorate daily until within the last few weeks of the pregnancy, when the dose is reduced to 2½ grains. He states that he has successfully treated several cases in this way.

Protargol. Von Astruc and Cambe⁴ have pointed out that the precipitation which occurs by the mixing of protargol and cocaine hydrochlorate may be avoided by the use of a 1.5 per cent. solution of boric acid as a solvent. They state that the precipitation is due to a slightly alkaline reaction of the protargol, and that this is counteracted by the boric acid.

Pyranum is a whitish, slightly hygroscopic, crystalline powder of a weakly aromatic smell and sweetish taste. It is soluble in water, 1 to 5 parts, and in alcohol 1 to 10 parts. Chemically it is a combination produced from benzoic acid, salicylic acid, and thymol.

Schlesinger⁵ reports his results after using the drug in 146 cases, extending over a period of six months. According to Schlesinger, it is most efficient as an antifebrile remedy, antiasthmatic, and in relieving the various forms of nerve pain. He used it most frequently in *influenza*, *rheumatism*, *migraine*, and purely symptomatic pains. From animal experimentation he determined the dose to be from 7½ to 15 grains, and recommends the giving of larger doses if no result is obtained with the smaller ones. It is best administered in wafers; or better yet in gelatin capsules. If administered in powdered form it must be given in cold water, because if placed dry on the tongue, burning may result from the volatile substance it contains. For the same reason it should

¹ Med. Blätter, 1902, No. 17.

² Therapeutische Monatshefte, 1902, No. 7.

³ Merck's Archives, 1903.

⁴ Bulletin des Sciences Pharm., Journal American Medical Association, December 17, 1902.

⁵ Therapeutische Monatshefte, January, 1903.

not be given in warm water. Schlesinger states that as an antipyretic it is superior to other drugs used for reducing the temperature in that it also improves the general condition of the patient.

Quinine. Christian¹ has made comparative studies on *quinine hydrochlorate* and some of the newer derivatives of quinine. His conclusions are that none of the newer preparations possess the therapeutic value of the hydrochlorate of quinine in *malaria*. He advocates the subcutaneous administration of the drug, as but half the quantity given by the mouth is needed, and, in addition, a much smaller percentage is excreted by the urine. Christian also believes that by giving the drug subcutaneously it is deposited in the tissues, and thus protects against further attacks of malaria.

Aufrecht² adds urethane to the hydrochlorate of quinine when the latter is used hypodermically. He claims that the urethane increases the solubility of the quinine, and thus does away with the necessity of injecting large amounts of fluid into the tissues. The solution is prepared in the following way :

R.—Quininae hydrochloratis		0.5
Urethani		0.25
Aquae destillatæ		5 0

Smyth³ gives the following directions for the hypodermic use of quinine: Either the *hydrobromate* or the *bisulphate* should be used the former is the more soluble, while the latter is the more powerful. The hydrobromate is freely soluble in the proportion of 1 grain to 4 minims of warm distilled water; the bisulphate requires warming before use, as crystals are deposited on cooling. An easy method of accomplishing this is to place the bottle containing the solution in a cup of warm water. The usual dose for an adult is 5 grains, and in severe attacks of malaria this may be increased to 10 grains. The most suitable point for injecting is in the back of the arm or in the flank. After carefully sterilizing the part the solution is warmed and the syringe is washed out with warm water in order to prevent the precipitation of the quinine. The needle is smeared with carbolized oil and the solution quickly injected into the subcutaneous tissues. After the injection is made a small bleb is formed, which should be dispersed by gentle massage. Care must be taken not to inject the solutions into a muscle or endermically. When injected in the latter way a slough is a common result.

It is the belief of many observers that owing to the action of quinine on the uterus it is unsafe to use the drug during pregnancy.

¹ Deutsche med. Wochenschrift, March 19, 1903.

² Therapeutische Monatshefte, February, 1903.

³ British Medical Journal, November 2, 1902.

Maggi,¹ however, has reported twenty cases in which quinine was administered freely to pregnant women without in a single instance producing abortion. He states that pregnant women suffering from malaria should always be given quinine, as the danger from the malarial infection is greater than from the quinine. He also noted that the children were unusually healthy and robust.

Betti, in the same journal for June, agrees with Maggi, and states that the mother and foetus are not only protected, but that their general health is improved.

QUININE AS AN ANTISEPTIC. Marx² has studied the effect of the hydrochlorate of quinine, in solutions of various strengths, on bacteria. His results showed that as an antiseptic the drug is superior to carbolic acid and formalin, and that it occupies a place between formalin and corrosive sublimate. In addition to its antiseptic properties, Marx states that it has a marked styptic action. The latter property was demonstrated by adding 1 drop of the quinine solution to 1 drop of human blood, when agglutination of the red corpuscles was easily seen. Gauze saturated in a solution of quinine hydrochlorate may be applied to wound surfaces or used as a packing in cavities. As a wet quinine tampon is apt to give rise to an odor, it is not advisable to allow it to remain longer than twenty-four hours. Marx used the following formula :

R.—Quinin. hydrochlorat.		5 grammes (75 gr.)
Spts. rectificati	15	" (7½ 3)
Aquæ	ad. 150	" (9 3)

In addition he used a 1 per cent. quinine gauze for packing. The gauze was prepared as follows :

R.—Quinine	5 grammes (75 gr.)
Alcohol	15 " (7½ 3)
Water	170 " (10½ 3)
Gauze	500 " (27 3)

The effect of this preparation is the same as iodoform gauze without the disagreeable odor of the latter.

Quinaphenine. This remedy has not been employed to any great extent, but its analogy to aristoquinine makes it at least worthy of mention. Quinaphenine is described as a tasteless white powder only very slightly soluble in water, but extremely so in alcohol, ether, and acids. Because of its slight taste it may be easily administered to children without difficulty, and for this reason Noorden has recommended it in the treatment of pertussis. For nursing he prescribes

¹ La Clinica Obstetrica, April, 1902.

² Münchener med. Wochenschrift, April 22, 1902.

from $\frac{1}{3}$ to $\frac{1}{2}$ grain (0.02 to 0.03 gramme) three times daily. Older children may be given from $\frac{1}{3}$ to 1 grain (0.02 to 0.06 gramme) many times during the day.

Salicylates. J. J. Walsh¹ believes that in *acute articular rheumatism* the salicylates should be administered in large doses—90 to 120 grains daily—during the acute stage. Contraindications to their use are dyspeptic symptoms and any impairment of the function of the kidneys. Walsh states that there is a form of dyspnoea that sometimes develops under the use of the salicylates which is characterized by deep though rapid breathing. He prefers the genuine oil of wintergreen to the synthetic products. The daily dosage should be arranged so that the remedy need not be taken after 4 P.M. until the next morning. Heart complications may be prevented by combining one of the alkalies with the salicylates. Walsh states that at the present time there is doubt as to whether the salicylates really affect the rheumatic process itself, though they do relieve the pain, fever, and restlessness.

In an abstract from the *New York Medical Journal* the following formula is recommended in the treatment of soft chancre :

R.—Acid. salicylati	gr. xxiv.
Tr. benzoini	3 ss.
Petrolati	3j.

Sig.—Apply night and morning.

Salophen² closely resembles salol both in its physical properties and its therapeutic application. Like salol, it is comparatively useless in the acute form of *rheumatism*, but is of value in the chronic types of the disease. The drug is also recommended in influenza of the nervous type, and for the relief of the after-pains in parturient women. Owing to the fact that salophen contains carbolic acid, which is liberated in the intestinal canal, the drug is of value also as an *intestinal antiseptic*.

Saloquinin has been introduced as a substitute for the salts of quinine in cases in which the latter are contraindicated on account of their well-known disadvantages. Pirkner³ has used saloquinin in a variety of affections, with good results. He found it of particular value in cases suffering from acute or subacute diseases of the middle ear or from gastrointestinal irritation—conditions which quinine may easily aggravate. Pirkner states that in *malarial fever* it is quite as efficient as quinine, and that it also possesses marked analgesic and diuretic properties. It is not soluble on the tongue, and has no taste whatever. Saloquinin is given in doses of 15 grains each ; as much as 90 grains may be given in twenty-four hours.

¹ Journal of the American Medical Association, January 24, 1903.

² Editorial, American Medicine, April 25, 1903.

³ Medical News, February 7, 1903.

Septoforma. This new antiseptic product consists of condensation products of formaldehyde with bodies from the terpen, naphthalin, and phenol group. It is dissolved in an alcoholic solution of linseed-oil soap to a yellowish-brown, transparent, slightly soapy smelling fluid which is miscible in water. It renders the skin soft and smooth, and not so slippery as lysol; even in concentrated solutions it does not cause the slightest irritation. Engels,¹ of Marburg, conducted experiments which showed that in a 2 per cent. solution it would kill the cholera vibrio in three minutes and the bacillus prodigiosus in ten minutes. A 3 per cent. solution killed the staphylococcus pyogenes aureus in three minutes and the typhoid bacillus in ten minutes. It is highly spoken of by Bruin and Sternberg for uterine douching, and is also of value in infected wounds. In a 5 per cent. solution it was also found of value as a deodorant. Instruments may be disinfected, without harm, in a 5 to 10 per cent. solution.

Serum for Hay Fever. In PROGRESSIVE MEDICINE for December, 1902, p. 326, mention was made of Curtis' efforts to produce a curative agent for hay fever from the pollen of plants. Shost² now reports the results of Dunbar, who has produced a curative serum for hay fever. The pollen of plants was dissolved in ether and the toxins precipitated with alcohol. Injection of the toxin into persons subject to hay fever produced the ordinary manifestations of the disease, while individuals not subject to it manifested no signs. The toxins were then injected into animals (rabbit, goat, horse) and a serum obtained which it is believed will have a favorable influence on the disease. The toxins and antitoxins so far used have been obtained from maize. Dunbar has also isolated toxic pollen from eighteen different grasses. If they all prove to be identical a specific treatment for hay fever may at last be realized. Hay fever patients treated with this serum did not react, after a time, to the irritation which the freshly introduced pollen produced. Furthermore, if the serum was mixed *in vitro* with the pollen toxin the mixture produced no irritation in susceptible persons. That the serum apparently has a specific action is shown by the fact that asthma and catarrhal conditions of the bronchial mucous membranes are uninfluenced.

McCoy³ has recently published the results he obtained with Dunbar's serum in the treatment of hay fever. His cases comprised fifteen of the true periodic type of the disease as it occurs in the late summer and early autumn.

The serum was applied to the eyes and nasal mucous membrane by

¹ Medicinische Wochenschrift, 1902, No. 40.

² Münchener med. Wochenschrift, June, 1903.

³ New York and Philadelphia Medical Journal, November 21, 1903.

means of a pipette. From one to three drops were applied to each conjunctival mucous membrane two to four times daily; two to four drops were instilled into each nostril two to six times daily. McCoy states that the results were truly marvellous, the action being prompt and the relief complete.

The result was lasting for this season, but whether the serum will give a permanent result can only be settled by time. At any rate the most distinct advance yet recorded has been made in the treatment of hay fever.

The experimental results obtained by Dunbar have been confirmed by Sir Felix Semon and McBride, namely: that the toxin applied to the mucous membranes of susceptible persons produces the ordinary manifestations of hay fever, and that these symptoms were relieved by the serum. The controls or non-susceptible individuals showed no irritation of the mucous membrane whatever.

Emil Mayer¹ conducted some experiments with the type of the disease known as spring hay fever. In all such cases he obtained a positive reaction, while in cases subject to the autumnal variety he obtained no such reaction.

Serum for Morphinism. The early statements of Ehrlich, Wasserman, Aschoff, and others, that only those poisons can elaborate protecting substances in the blood which are able to enter into chemical combination with the cells of the body, has discouraged investigations with drugs. Besredka, however, has established a certain natural immunity against arsenous acid in animals, and Calmette has proved that rabbits possess a far-reaching power of resistance against the subcutaneous and intravenous introduction of atropine.

Hirschlaff² has also produced, apparently with some success, an anti-toxin against morphine poisoning, both of the acute and chronic varieties. His experiments were first conducted with animals (rabbits and mice). By gradually ascending doses of morphine he succeeded in rendering the animals immunized to the maximum lethal doses. Serum was obtained in the usual manner, by bleeding, and under strict antiseptic precautions; 5 c.c. of serum from the immunized animals protected non-immunized animals which had received several times the lethal dose of morphine.

Hirschlaff was able to demonstrate the effects of the morphine anti-toxin in six cases; one was a case of acute opium poisoning, while the other five were cases in which the drug had been used for a long time for the relief of pain or insomnia. Unfortunately, he was unable to try the effects on morphine habitués.

¹ New York and Philadelphia Medical Journal, August 3, 1903.

² Berliner med. Wochenschrift, December 8, 1902.

The acute case is of interest because of the rapid recovery after taking double the lethal dose. The treatment consisted of the subcutaneous injection of 6 c.c. of the morphine antitoxin and, in addition, lavage of the stomach, two cups of strong black coffee, two 5-minim injections of camphorated oil, and $\frac{1}{100}$ grain of atropine. Aside from the antitoxin, Hirschlaff does not consider this very active treatment, especially when all evidences of the poisoning had practically disappeared in five and one-half hours from the taking of the drug. Of the five cases which had been accustomed to the daily use of the drug, a single injection of 5 c.c. of the antitoxin enabled him, in two instances, to withdraw the morphine completely without any untoward results; two other cases, after from 1 to 3 doses of the serum, had the daily amount of morphine reduced one-half; the fifth case was relieved of many annoying effects of the drug, although she refused her consent to reducing the dose.

In conclusion, Hirschlaff states that he never observed the slightest local or constitutional damage resulting from the injections of the serum.

Tachiol is the fluoride of silver, and in its pure state occurs as colorless, transparent crystals, which change rapidly by contact with air. Exposure to slight degrees of temperature changes it to a yellow color, and, finally, to a black, horny mass. Tachiol was first introduced by Durante, of Rome.

Perez has conducted a series of experiments in order to determine its exact status as a surgical antiseptic. He found that it is non-irritating to the skin and does not injure instruments, but has the disadvantage of staining linen black. Owing to its powerful antiseptic properties and weak toxic effects, Perez believes it is of value in surgery.

In strengths of from 1:1000 or 1:5000 it may be used for the disinfection of *suppurating sinuses, tuberculous lesions, cystitis, proctitis, and urethritis*. Where a moderate caustic effect is desired it may be used in the strength of 1:1000.

Theocine (Theophylline). This new diuretic is isomeric with theobromine and paraxanthine. The alkaloid exists in tea, but because of the difficulty of extraction it has not come into general use. It is soluble in 180 parts of water at 15° C. and in 85 parts at 37° C. Minkowski¹ has employed both the alkaloid and its salts in the treatment of *cardiac and renal diseases*, and finds that the diuretic effect is most remarkable. After the remedy is employed for a time it gradually loses its effect. Of a series of fourteen cases treated by the author there was no increase in the activity of the heart and no decrease in the albuminuria. The drug is usually well borne, but large doses may produce gastric disturbances. The author considers the drug particu-

¹ *Therap. der Gegenwart*, November, 1902.

larly useful in the treatment of aortic insufficiency complicated with albuminuria. Its administration relieves dropsical conditions with great rapidity, as it causes a diuresis varying from 3 to 5 quarts (3 to 5 litres) during the twenty-four hours. The dose is from 6 to 8 grains (0.4 to 0.5 gramme) during the twenty-four hours.

Thigenol is a dark brown, syrupy liquid, odorless and almost tasteless; in water, dilute alcohol, and glycerin it forms a perfectly soluble liquid. It contains 10 per cent. of organically combined sulphur. Contrary to ichthyol, thigenol is perfectly odorless, dries on the skin as a non-sticky covering, and is easily removed by water. Applied externally, thigenol acts as an astringent, reduces inflammation, and aids in resorption.

Saalfeld¹ believes that its chief field of usefulness is in the treatment of *eczema*. Silberstein, however, has used the drug internally in the treatment of *bronchiectatic cavities* and *chlorosis* with alleged benefit. Practically it may be used as a substitute for ichthyol, the only advantage being its cheapness.

Thiocol is a derivative of guaiacol and possesses the properties of the latter without its disagreeable after-effects. It is a soluble powder, and clinical experience seems to show that it is of value in the treatment of *pulmonary tuberculosis*.

Drago² has also demonstrated that it increases the number of red blood corpuscles in proportion to the hæmoglobin. *Sirolin* is the syrup preparation of thiocol.

Thyroid Extract. The value of thyroid extract in cases of persistent hemorrhage has been alluded to by Dr. Bloodgood in the present volume. Fuller³ gives two additional instances demonstrating its hæmostatic power. His first case was a boy, aged fifteen years, who was undoubtedly a *hæmophilic*. When the boy came under Fuller's care he was greatly weakened as the result of frequent spontaneous hemorrhages, particularly from the kidneys. The usual styptics failing, and the boy's condition becoming desperate, Fuller administered 5 grains of thyroid extract three times daily. After the first few doses the bleeding ceased, and in a week the boy's general condition had greatly improved. Nine months later his health was better than it had been for years. He was kept during this time on 2½-grain doses of the thyroid extract three times daily.

Fuller's second case was a man, aged fifty-five years, with persistent hemorrhage from a prostatic sinus and severe hemorrhage following operation for the relief of this condition. The administration of

¹ Therapeutische Monatshefte, April, 1903.

² Klin. therapeut. Wochen., August, 1902.

³ Medical News, February 28, 1903.

5-grain doses of thyroid extract, three times daily, stopped the hemorrhage at once. This case was also continued on small doses, and several months later had had no return of the bleeding.

The use of thyroid extract in the treatment of the *autointoxications of pregnancy* is advocated by Nicholson.¹ He believes that when a pregnant woman threatens to become eclamptic, as shown by albuminuria or other symptoms, that the thyroid extract should be pushed until it produces a marked effect on the circulation. According to Nicholson, thyroid extract is an excellent diuretic and vasodilator, and, because of this latter property, produces active perspiration and lowering of the blood pressure.

Ulmaren² is an orange-colored fluid, with a faint odor resembling salol. It is a mixture of the ethyl and amyl salicylates, and represents 75 per cent. of salicylic acid. Cohen states that it has been recommended as an external application in *rheumatic neuralgic* diseases and *gout*. It can be painted over the affected part with a camel's-hair brush or applied in the form of lanolin ointment. When used as an ointment the ulmaren should be present in the proportion of 30 per cent.

Tuberculin. The value of tuberculin as a diagnostic aid is now pretty generally conceded. Madison³ gives the following conclusions as to its advantages and limitations:

1. Patients may react to tuberculin and no evidence of tuberculosis be found at autopsy.
2. Healed lesions of tuberculosis may react.
3. Cases of proved tuberculosis may not react to the maximum doses.
4. The evidence is not conclusive that other diseases than tuberculosis will not react to tuberculin.
5. The margin of error of the tuberculin test is considerable, and probably not less than 10 per cent.
6. The maximum dose should be higher than 4 milligrams and not more than 10 milligrammes. Small, increasing doses are not advisable, as the reaction is not so likely to be distinct on account of the tolerance which may be produced. An initial dose of from 3 to 5 milligrammes, followed by the maximum dose, is better.
7. The temperature should be normal before the injections are given.
8. It seems quite certain that the glycerin extract of tuberculin deteriorates, and a fresh bottle should frequently be opened, care being taken to keep it in a cool, dark place. The author believes that dete-

¹ Scottish Medical and Surgical Journal, March, 1903.

² Editorial, American Medicine, April 25, 1903.

³ American Medicine, December 20, 1902.

rioration of tuberculin is the principal factor in producing delayed reactions.

9. It cannot be said that tuberculin injections are entirely without ill effects, but their use among suitable patients is no more dangerous than the use of chloroform and ether for diagnostic purposes, and is quite as justifiable, as an early diagnosis of tuberculosis is of the greatest importance.

Among those who have had much experience with tuberculin, exception would probably be taken to several of Madison's conclusions, particularly the first two. It has never been definitely proved that a case reacting to tuberculin had no evidence of tuberculosis at some place in the body, and it is the generally accepted belief among those who have used tuberculin that the presence of tuberculosis, whether healed or not, will give a reaction except in advanced cases, where failure to secure a reaction is common. As to the danger of using tuberculin, opinion varies, although those believing it harmful are probably in a small minority. It may be of interest to state that at Saranac Lake, where tuberculin has been used in hundreds of cases, both as a diagnostic and curative agent, there is yet to be noted an untoward result.

The initial dose of tuberculin when used for diagnosis varies considerably with different observers. All are agreed, however, that the initial dose should be small and gradually increased to not more than 10 milligrammes if failure occurs with the smaller amounts.

Dunn¹ has contributed the most recent article on its use in diagnosis, and while he strongly advocates giving it in cases with doubtful physical signs, he condemns it absolutely in those cases where the diagnosis is apparent.

The exact status of tuberculin as a curative agent in pulmonary tuberculosis is still an unsettled question. Goetsch² reported some remarkable results after using tuberculin for its curative properties, and Roemisch³ states that the results obtained by Goetsch induced him to give tuberculin a trial. In incipient cases favorable results were obtained, and, in addition, Roemisch found it was of decided value in advanced cases in which no improvement was shown under the most favorable hygienic and dietetic treatment.

Roemisch states that tuberculin is contraindicated in cases with fever or extensive lesions of the lung. He also states that nervous patients bear the treatment badly. His method of administering the tuberculin was to begin with a minute dose and gradually increase the amount.

¹ American Medicine, October 17, 1903.

² Deutsche med. Wochenschrift, 1901, No. 25.

³ Münchener med. Wochenschrift, November 25, 1902.

Hager¹ has been using tuberculin as a diagnostic and curative agent for the past ten years. He avoids strong reactions and keeps his patients in bed on the day following the injection. Hager believes that the specific treatment with tuberculin should be combined with hygienic and dietetic measures.

Pottinger² has written an excellent review on the use of tuberculin and allied products in the treatment of tuberculosis. While he believes that they should have an extended use, he also believes that no one should undertake their administration who is not thoroughly familiar with both the remedy and the disease.

In this country tuberculin, while quite extensively used as a diagnostic aid, is not looked upon with much favor as a curative agent. It has been used for this purpose in selected cases for some years past at the Adirondack Cottage Sanitarium, at Saranac Lake. Although no untoward effects have been noted, the benefit it may do is questionable. Many of the patients, however, who have received this treatment return with the request that it be continued, as they feel better while receiving the tuberculin.

Urosin has been introduced as a uric-acid solvent. According to Lang,³ it is of excellent service in *gout*, because, in addition to its ability to dissolve uric acid, it has marked pain-relieving qualities. It is best given in tablet form, each tablet containing $7\frac{1}{2}$ grains. In acute cases of gout from six to ten tablets may be given daily; in chronic cases and as a prophylactic four tablets daily are given.

Urotropin and Uritone. The value of these drugs in *typhoid bacilluria* and *cystitis* is now generally recognized. In typhoid bacilluria Bliss⁴ advocates giving the urotropin early without waiting for a positive diagnosis of the Eberth bacillus; this can be done later. As the drug is harmless, the slightest cloudiness of the urine during the course of typhoid fever should be an indication for its use. Bliss prefers administering the urotropin every eight hours. In giving the drug morning, noon, and night too long an interval elapses between the evening and the morning dose. If necessary urotropin can be given in 20-grain doses every eight hours. In typhoid bacilluria it should be continued for some time after the bacilli have apparently ceased to multiply in order to prevent a relapse.

Janet⁵ believes that for all forms of *bacteriuria* urotropin is the best drug to give internally. He advises the use of 20 grains daily, but

¹ Münchener med. Wochenschrift, July 22, 1902.

² Therapeutic Gazette, January 15, 1903.

³ Klinische therapeutische Wochenschrift, March 1, 1903.

⁴ Edinburgh Medical Journal, October, 1902.

⁵ Annales des Maladies des Organes Génito-urinaires, 1903, No. 3.

this amount may be tripled. In his experience the drug is not always well tolerated, even in small doses. It sometimes causes vesical irritability, and in one instance Janet observed it produced a *hæmaturia*. He states that patients should be tested for idiosyncrasy before administering the urotropin in full doses.

Vioform is an odorless neutral powder which has been introduced as a substitute for iodoform. It possesses, to an unusual degree, the power of preventing the decomposition of secretions and the odor arising therefrom. It is stable, and resists the action of light, moderate heat, and most solutions. It can be mixed readily with carbol, lysol, and cresalol solutions, and from these medicated gauze may be prepared. According to Tavel,¹ it is as good as iodoform in tuberculous affections and much more effective in non-tuberculous wounds.

Blake² has made a series of animal experiments with vioform, and concludes that in consequence of its insolubility and stability it is probable that in most cases neither the powder nor its decomposition products are absorbed in appreciable quantities, providing it is used in localities whence free escape of the secretions is possible. It is not suitable for injections, as without free drainage it gives rise to abscesses and an intoxication of considerable severity. In powder form or as gauze impregnated with the drug it is particularly adapted to fresh wounds or tuberculous sinuses communicating freely with the external surface.

Blake believes that vioform has higher antiseptic qualities than iodoform, and, in addition, is free from the disagreeable odor of the latter.

The X-rays. In the September number of *PROGRESSIVE MEDICINE* for 1903 Dr. Gottheil gave an excellent review of the therapeutic results achieved by the Roentgen ray. Recently there have appeared several articles calling attention to the limitations of the rays as now used, and also emphasizing certain dangers which may result from their use. Leonard, who has had an extensive experience, warns against the alterative and destructive changes sometimes produced. He states that in large subcutaneous growths of low vitality such rapid destruction may take place as to flood the system with toxins, and thus cause a fatal autointoxication or septicæmia. Leonard believes that when the proper dosage is established for the various manifestations the rays will probably be one of the most valuable methods we possess. In Leonard's opinion the rays have no place at present as a preliminary method except in cases distinctly inoperable or where cosmetic effects are desired and life is not threatened by delay. In all other cases operative treat-

¹ *Deutsche Zeit. f. Chirurgie*, Band lv., Heft 5 u. 6.

² *Brooklyn Medical Journal*, October, 1902.

ment should proceed and the X-rays used only to deal with the residue which has escaped the knife.

Roswell Park¹ has contributed an excellent article on the physical and therapeutic value of the cathodal and ultraviolet rays. Park's conclusions are:

1. These rays afford methods of treatment for extremely new-growths of limited area and superficial character which, while not exactly certain, are extremely promising.

2. They not only cause no pain but tend to relieve pain, both superficial and deep, in a most pleasing and satisfactory way.

3. They are adapted to cases which can hardly be submitted to any other method of treatment, and they afford more hope in delayed or inoperable cases than does any other method of treatment.

4. It will be found that the odor of putrefaction may often be suppressed by their use and the putrefactive process itself checked.

5. Burns and intense dermatitis, so frequently noted when the treatment first came into vogue, may now be almost certainly avoided.

6. More than this, the rays afford a supplementary method of treatment after operation by which the benefits of the same may be enhanced and enlarged.

7. It is not necessary to intermit such work as the patient may be engaged in in order to carry out the X-ray or phototherapeutic method of treatment.

At the fifty-fourth meeting of the American Medical Association, Nichols stated that he had seen a number of cases in which epitheliomata had skinned over after treatment with the X-rays, but the disease had remained in the deeper tissues. At the same meeting Lund called attention to the fact that most cases of carcinoma successfully treated by the X-rays were of the non-malignant epithelial variety.

Lund's views agree with those expressed by Leonard,² namely, that a malignant growth should never be tampered with, but should be widely excised as soon as possible, and, in addition, the neighboring glands should be removed.

The results obtained with the rays in inoperable cases are shown in a paper written by Holding.³ He reports four cases of his own, and, in addition, has collected 148 cases from the literature. A study of these cases shows that 32 per cent. were apparently cured, 58 per cent. were improved, and only 10 per cent. were unimproved. As has been noted before, the most favorable results were obtained in the cases with superficial growths, as epithelioma of the face and mammary carcinoma.

¹ Medical News, May 30, 1903.

² Loc. cit.

³ Albany Medical Annals, February, 1903.

It is important to note that in six cases (reported by Pusey) of abdominal cancer the result was unfavorable in each instance.

In a paper read before the Edinburgh Medico-chirurgical Society, Turner¹ reported eighteen cases, nearly all of them inoperable malignant disease. Marked improvement was shown in all, but the best results were obtained in the breast cases. Turner states that, clinically, there was noted a diminution of the pain and loosening of the adhesions, with relief from the contracting and tightening feeling. In addition, the ulcerating and sloughing surface took on a healthy appearance, the tumor diminished, and a growth of epithelium started at the edges.

Bryant² also believes that good results are obtainable in inoperable cases of carcinoma, particularly those affecting the breast and skin. He does not think one is justified in giving assurance of a cure, but the rays often relieve pain and arrest the growth of the tumor. Bryant believes that cancer of the rectum is amenable to the X-ray.

Morton³ has reported twenty cases of mammary carcinoma treated by the X-rays. He states that in all these cases the tumor either disappeared or there was marked improvement shown. His best results were obtained in recent and superficial growths. From the opinions already quoted and from surgical statistics it is seen that it is in this very class of cases, however, that the X-rays should not be used as a preliminary measure.

Skinner,⁴ in accord with other writers, confirms the good results obtained with the X-ray in the treatment of lupus vulgaris, lupus erythematosus, and epithelioma. In Skinner's opinion it is doubtful, however, whether the X-ray will ever become an active competitor in the treatment of acne, psoriasis, eczema, rheumatism, or neuralgia, although two or three striking results have been obtained in the latter condition.

Childs⁵ has reported a series of cases in which favorable results were obtained. The cases of special interest were one of pulmonary tuberculosis, one of tuberculous glands of the neck, and one of Hodgkin's disease.

The case of phthisis was one with involvement of both apices, with signs of consolidation and moist râles. The chest and back were exposed on alternate days, and in all seventy-six treatments were given. Expectoration entirely ceased and the moist râles were no longer heard, but the signs of consolidation remained unchanged. The tuberculous

¹ *Lancet*, November 15, 1902, p. 1328.

² *British Medical Journal*, October 25, 1902.

⁴ *Ibid.*, December 27, 1902.

⁵ *Medical Record*, May 30, 1903.

⁵ *Medical News*, January 24, 1903.

glands of the neck showed a marked diminution while under treatment, and four months afterward had become almost imperceptible.

In the case of Hodgkin's disease the enlarged glands decreased in size, although not entirely disappearing.

Two cases of Hodgkin's disease successfully treated by the X-rays have been reported by Senn.¹

Morris and Dore² state that the X-ray is much inferior to the Finsen light in the treatment of lupus vulgaris. In dealing with mucous membranes, however, the X-rays are more effective.

When the Finsen light is used in the treatment of lupus vulgaris the resulting scar is soft, pliable, and non-contracting, while the scar from the X-ray is fibrous and tends to contract.

Yeast. Attention was called to the use of yeast in furunculosis in the December number of PROGRESSIVE MEDICINE for 1902. Poschkis³ has used yeast in twenty cases of *furunculosis*, *acne*, or severe *folliculitis*, with most satisfactory results. There is no inconvenience from its use except, possibly, if much sugar be taken at the same time flatulency may result from the fermentation.

Ullman,⁴ in a review on the value of yeast, concludes that because of its ferments, nuclein and nucleinic acid, and phagocytic action it is of value in therapeutics. Besides furunculosis and allied conditions, brewers' yeast has been used with benefit in *bronchitis*, *bronchopneumonia*, *enteroptosis*, and *habitual constipation*. It has also been used in *pulmonary tuberculosis* with secondary infection with alleged good results.

Yersin's Serum in Bubonic Plague. From a study of the epidemic of plague in Glasgow, Cairns⁵ concludes that Yersin's serum is of the greatest benefit. He has shown that the serum not only has an anti-toxic action, but, in addition, has marked bactericidal properties as shown by the degeneration and destruction of the bacillus pestis. In mild cases from 40 to 60 c.c. of the serum given subcutaneously will usually suffice, but in severe cases there should be given, in addition, an intravenous injection. The combined dose should be from 150 to 160 c.c. The subcutaneous injections should be given in the lymphatic area which drains the buboes. Intravenously the serum is usually administered in the median basilic vein. Several temperature charts are shown which indicate the drop in the temperature and pulse-rate after the administration of the serum. The subjective symptoms of the patient also showed marked improvement after receiving the serum.

¹ New York Medical Journal, April 18, 1903.

² British Medical Journal, June 6, 1903.

³ Wiener klin. Wochenschrift, July 17, 1902.

⁴ American Medicine, October 11, 1902.

⁵ Lancet, May 9, 1903.

Cruz¹ gives an interesting account of the accidents occurring in the serum treatment of bubonic plague. His observations were made in the epidemic at Rio Janeiro, and in comparing his results with those of European observers he finds them practically identical. The minor accidents were digestive disturbances, cutaneous manifestations, adenitis, and pain in the joints and muscles. Usually these disturbances were very slight and in no way interfered with the patient.

Among the more serious manifestations observed by Cruz were high temperature, intense pain, arthralgias and neuralgias, pulmonary phenomena, delirium, prostration, and adenitis accompanied with symptoms resembling plague.

Occasional cases of a profuse erythematous or purpuric eruption, with intense pain in the limbs and a marked adenitis, were also noted. In several instances after an injection of 10 c.c. of the serum there would result a high temperature, swelling of the lymphatic glands, intense pain, and a purpuric eruption.

Of 123 cases receiving the serum, 58, or 47.17 per cent., exhibited accidents, but only 7 were of a serious nature. Adenitis occurred alone or with other symptoms in 18.

Cruz states that the number of accidents noted at Glasgow was 47.3 per cent.

The value of the serum as a preventive is well illustrated in the case of an infected vessel entering Rio. The ship had one case of plague on board. The patient was removed to a hospital, and the rest of the crew were given prophylactic doses of the serum. At the end of twenty days two of the sailors developed symptoms of plague, evidently from the infected vessel, as the incubation period of plague is from eight to fifteen days. The effects of the serum are thus shown not to be lasting, but did apparently influence the degree of infection, as both cases were extremely mild. Cruz states that no fatal accident has occurred from the use of the serum, and in his opinion it is indispensable as a preventive. Ferrari² treated fifty-six cases of plague with serum, the mortality being 15.3 per cent. He found that the serum was prompt in its action, produced no local reaction, and the untoward results were transient and usually insignificant. In addition, the duration of the disease was reduced and the absorption of the exudate from the infected areas was hastened.

¹ Brazil Medico, 1903, No. 29.

² Ibid., xvii., No. 4.

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